I²C-bus Protocol & Applications
SASE, March 2010

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Product Line System Management
Business Line Interface Products

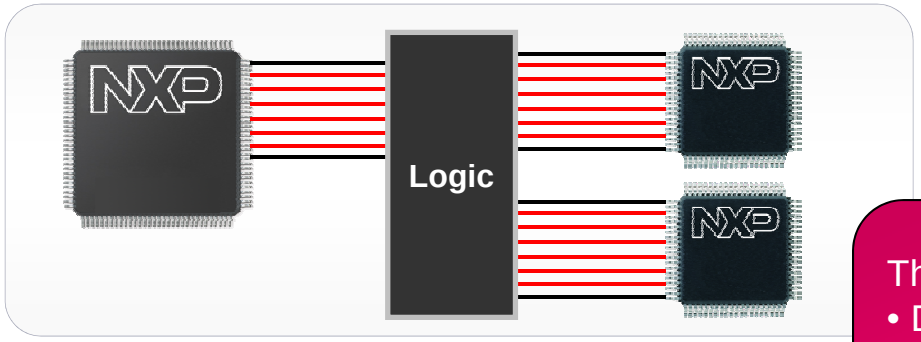
Agenda

- I^2C-bus Protocol
- Applications
- Support resources
- Questions

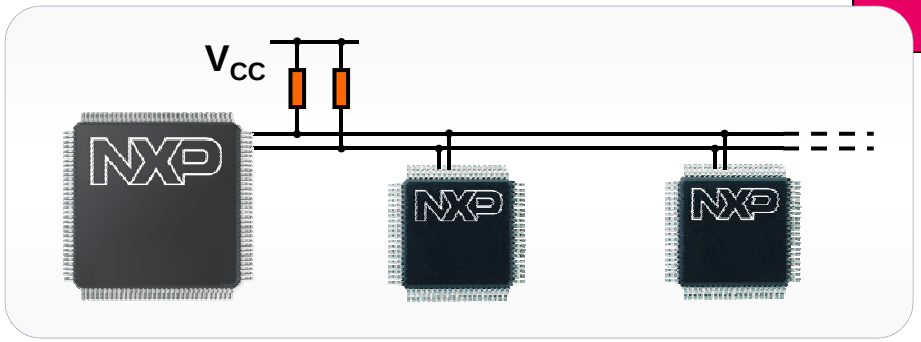
I²C-bus Protocol

I²C - Protocol

IIC - Inter-Integrated Circuit



I²C-bus



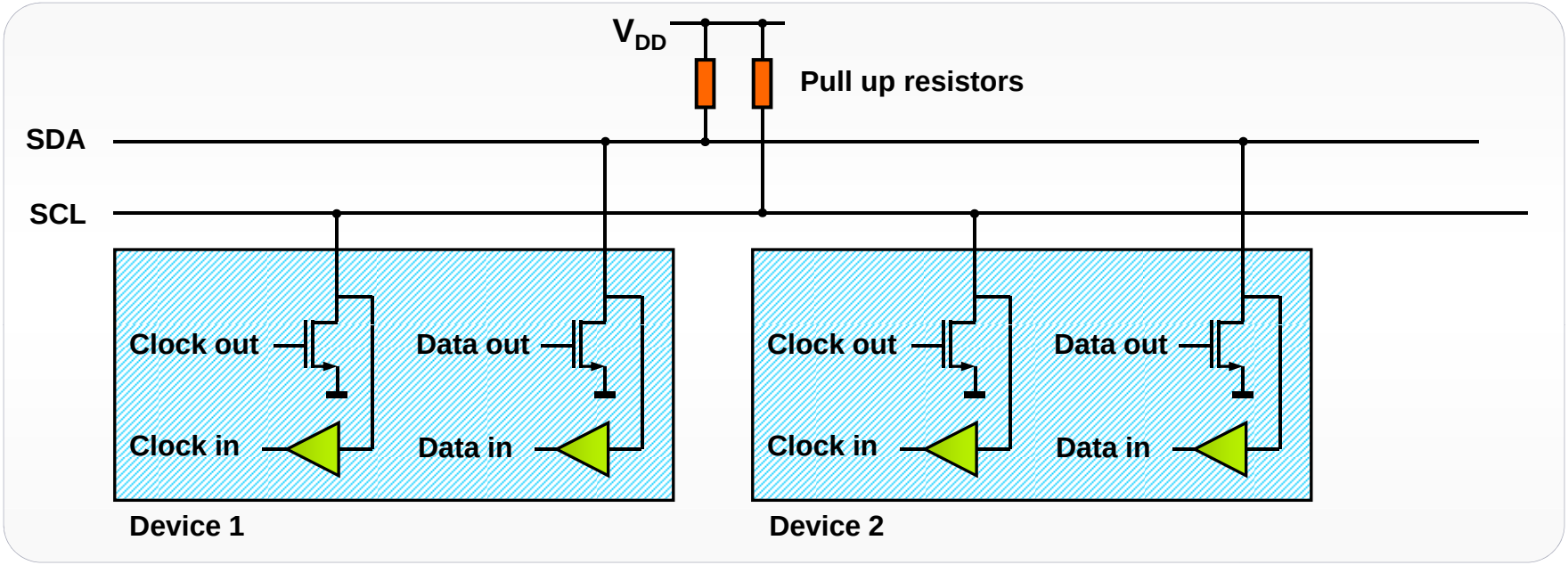
This means:
- Decreased number of wires (reduced PCB area)
- Reduced number of chip pins
- Remove glue logic
- Clip many devices on to the bus
- Modular design: Time-to-Market

Invented by NXP!
(Philips Semiconductors)

- I²C-bus developed in the late 1970's for Philips consumer products (e.g. TVs)
- Worldwide industry standard and used by all major IC manufacturers

I²C - Protocol

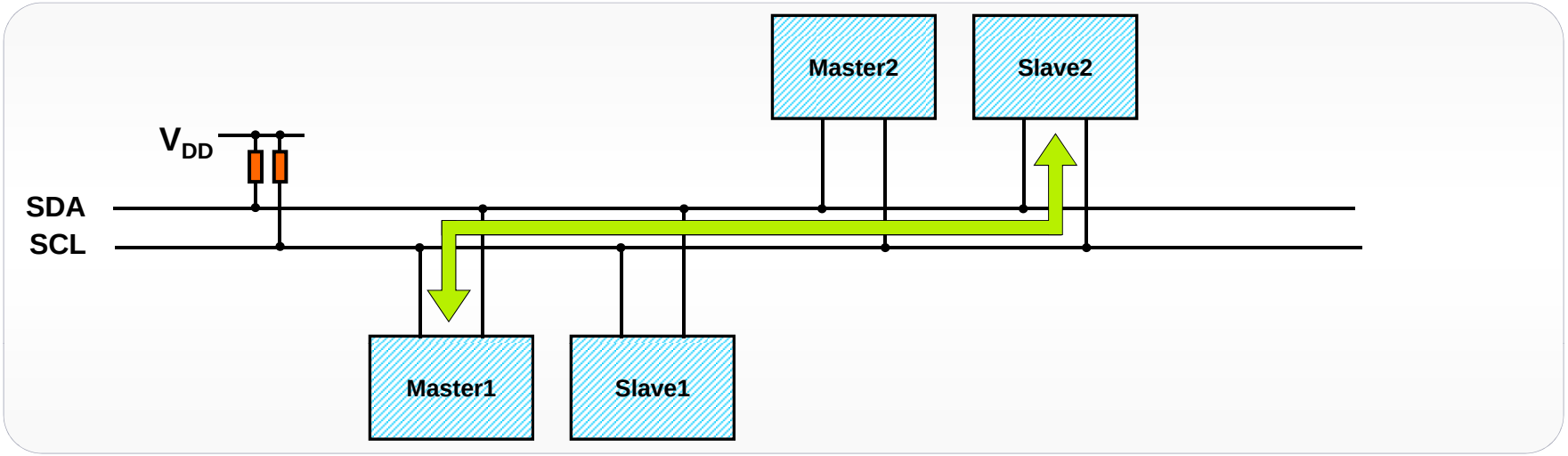
Hardware architecture



- 2 wire bus:
  - *SDA*: Serial *Data* Line
  - *SCL*: Serial *Clock* Line
- Open-drain or open-collector output stages: wired-AND function

I²C - Protocol

Hardware architecture (2)

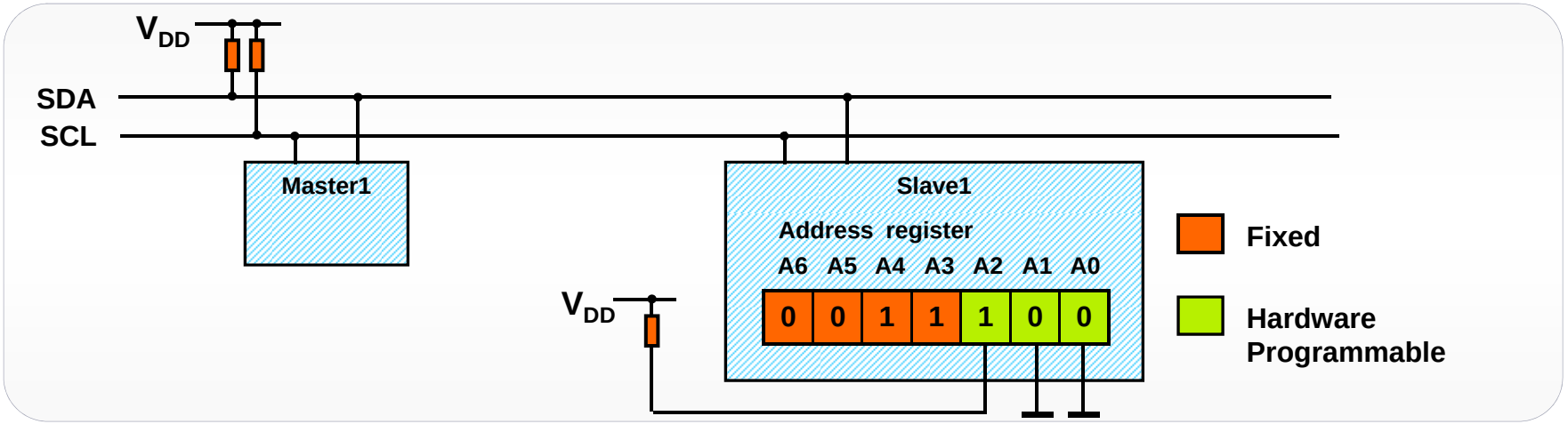


- Multiple master
- Multiple slave
- Bi-directional
  - Master-transmitter
  - Master-receiver
  - Slave-transmitter
  - Slave-receiver
- Data collision is taken care off

I²C - Protocol

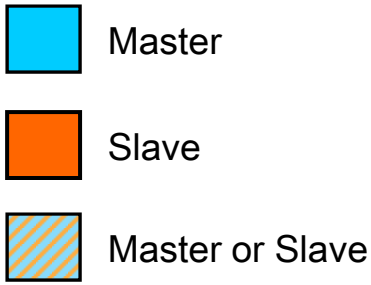
Addressing / device selection

- Each device is addressed individually by software
- New devices or functions can be easily “clipped" on to an existing bus!
- 112 different addresses max with the 7-bit format (others reserved); additional 1024 with 10-bit format
- Address allocation coordinated by the I²C-bus committee
- Programmable pins means that several of the same devices can share the same bus
- Unique address per device: fully fixed or with a programmable part through hardware pin's)
- 10-bit format use a 2 byte message: 1111 $0A_9A_8$R/W + $A_7A_6A_5A_4A_3A_2A_1A_0$



I²C - Protocol

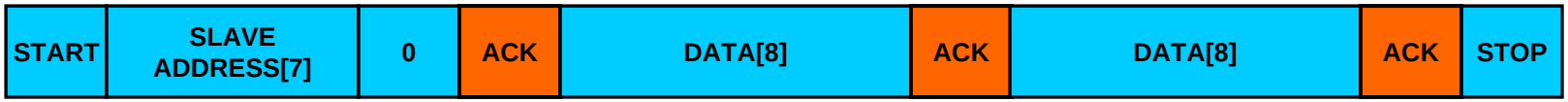
Communication



- Communication must start with: START condition
- Start bit is always followed by slave address
- Slave address is followed by a READ or NOT-WRITE bit
- The receiving device (either master or slave) must send an ACKNOWLEDGE bit
- Communication must start with: STOP condition

- Example:

  Transmit (0 = Write)

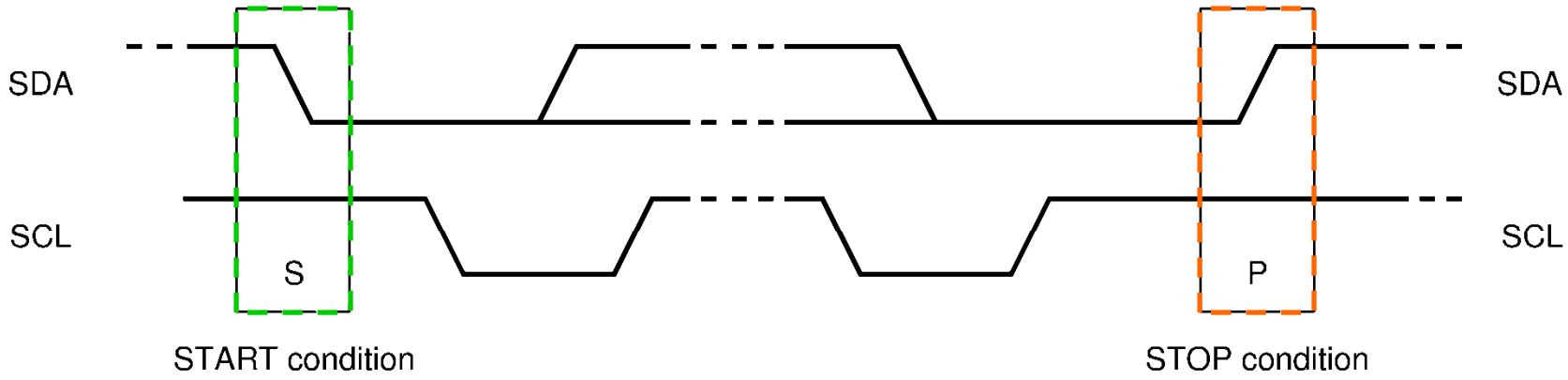


  Receive (1 = Read)

I²C - Protocol

START & STOP conditions

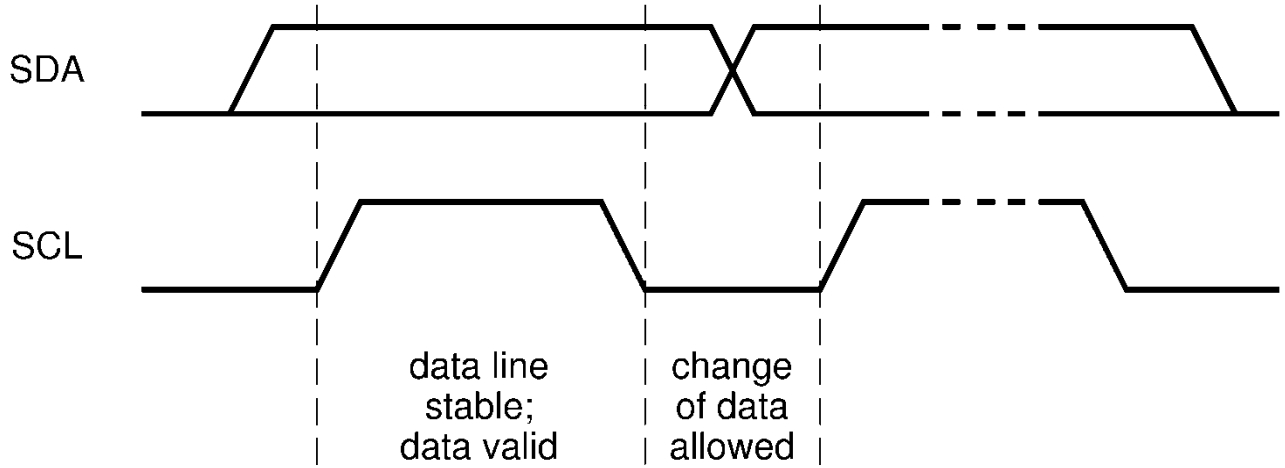
- Start condition - a HIGH to LOW transition on the SDA line while SCL is HIGH
- Stop condition - a LOW to HIGH transition on the SDA line while SCL is HIGH



I²C - Protocol

Bit transfer

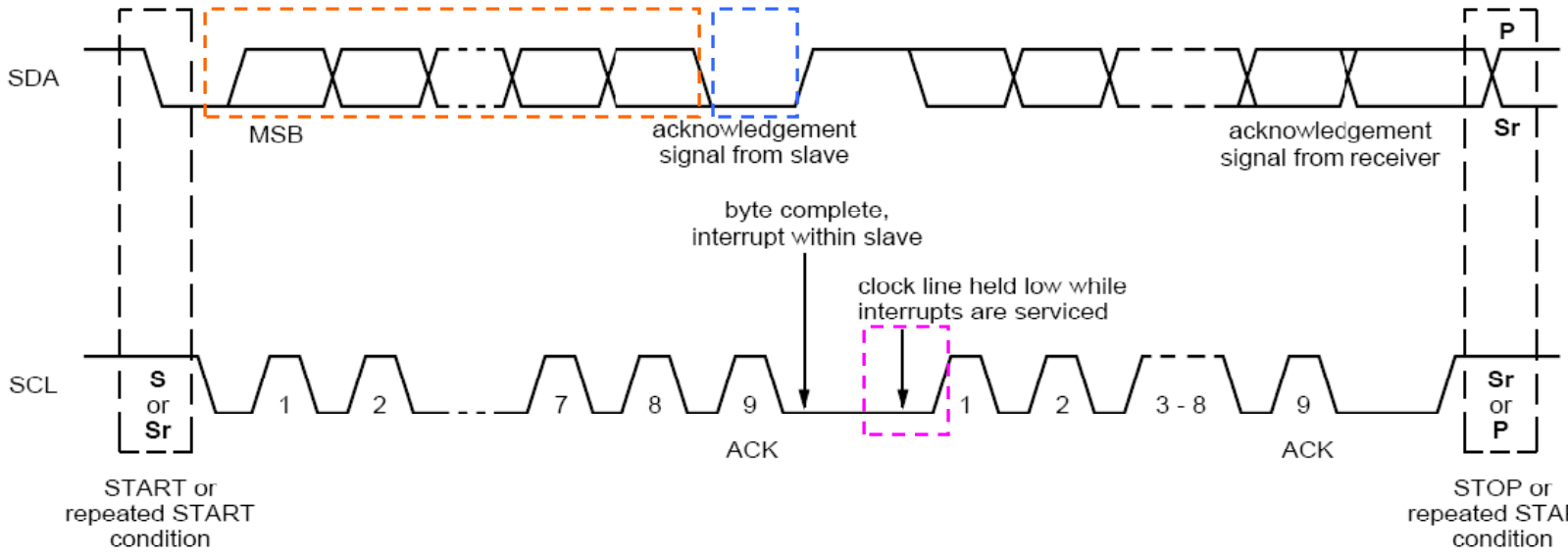
- During data transfer, SDA must be stable when SCL is High



I²C - Protocol

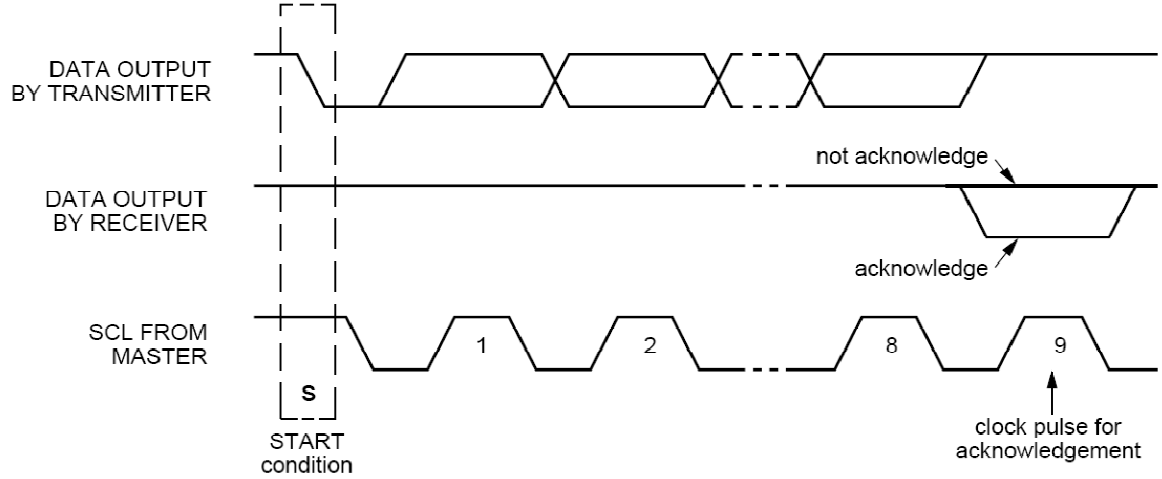
Data transfer

- Each byte has to be followed by an acknowledge bit
- Number of data bytes transmitted per transfer is unrestricted
- If a slave can't receive or transmit another complete byte of data, it can hold the clock line SCL LOW (clock stretching) to force the master into a wait state



I²C - Protocol

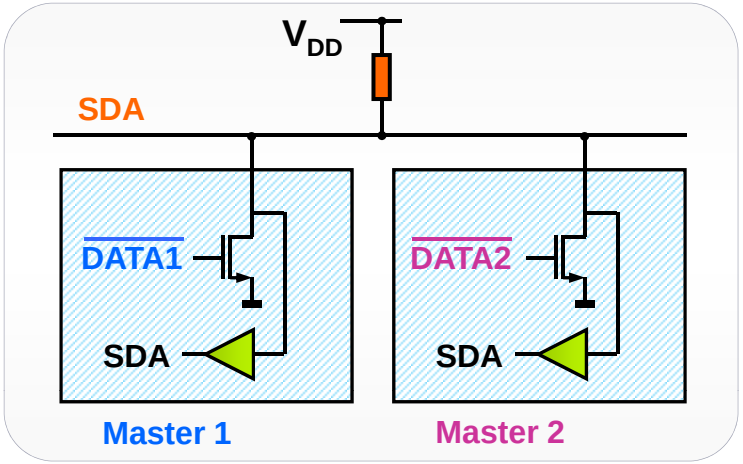
Acknowledge / NOT-Acknowledge



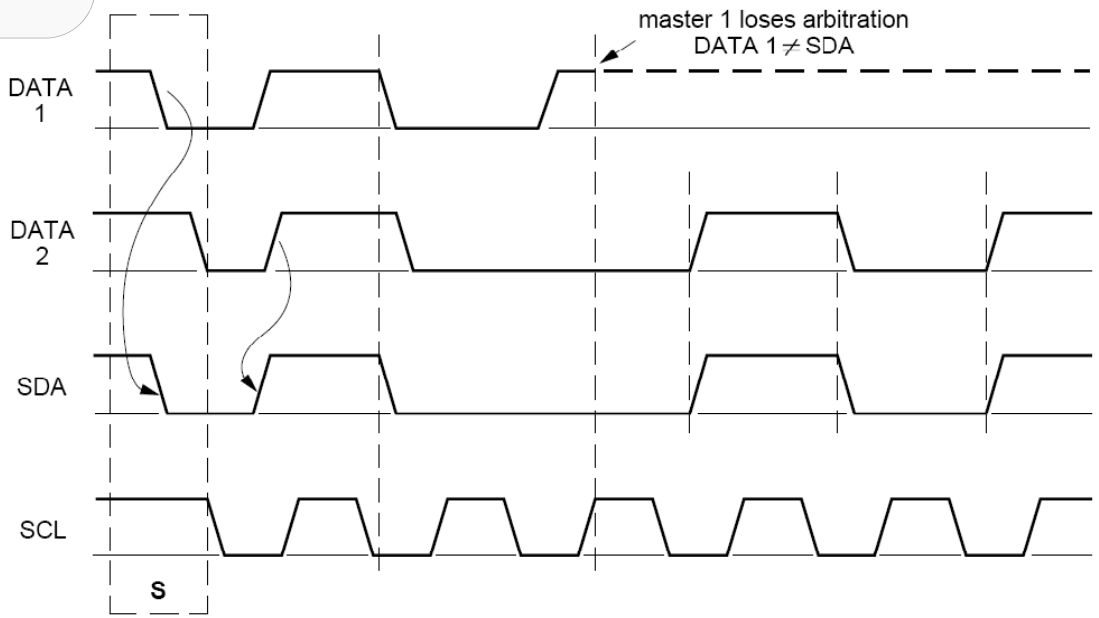
- I²C specification: Data transfer with acknowledge is obligatory. The receiver must pull down the SDA line during the acknowledge clock pulse so that it remains stable LOW during the HIGH period of this clock pulse.
- Scenarios with a NOT-acknowledge (NACK) (SDA staying HIGH):
  1. A receiver with the address is not present in the I²C bus.
  2. The receiver is performing real-time tasks and it cannot process the received I²C information.
  3. The receiver is the master and wants to take control of SDA line again in order to generate a STOP command. The slave transmitter MUST then release the SDA line when it sees the NACK so the master can send the STOP command.

I²C - Protocol

Arbitration procedure



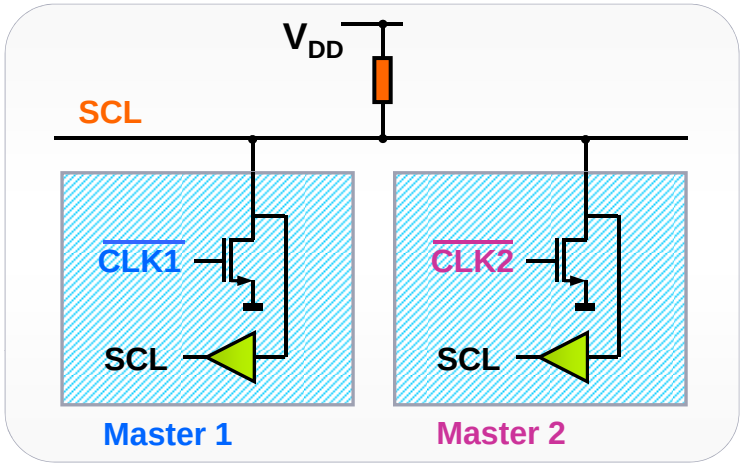
- Two or more masters may generate a START condition at the same time
- Arbitration is done on SDA while SCL is HIGH - Slaves are not involved



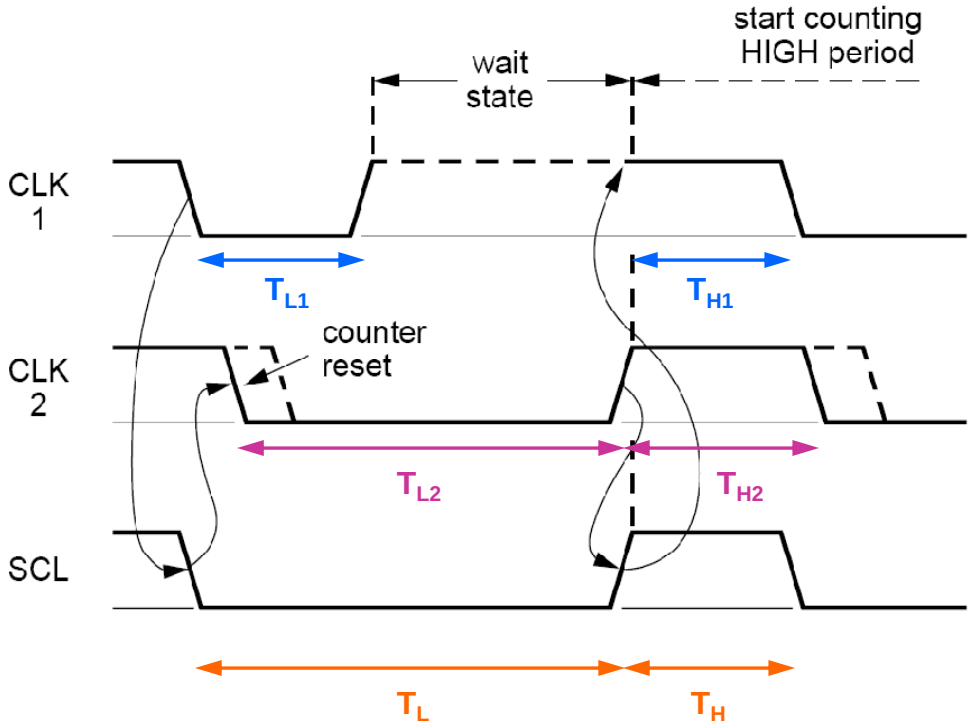
Summary: The master that first sends a “1” while the other sends a “0” loses control (arbitration)

I²C - Protocol

Clock synchronization during the arbitration procedure



Internal counters of masters count the LOW and HIGH times (T_{L1}, T_{H1}) and (T_{L2}, T_{H2})



Wired-AND SCL connection:
T_L= longest T_L= max (T_{L1}, T_{L2} ,T_{Ln})
T_H= shortest T_H= min (T_{H1}, T_{H2},T_{Hn})

I²C - Protocol

Modes

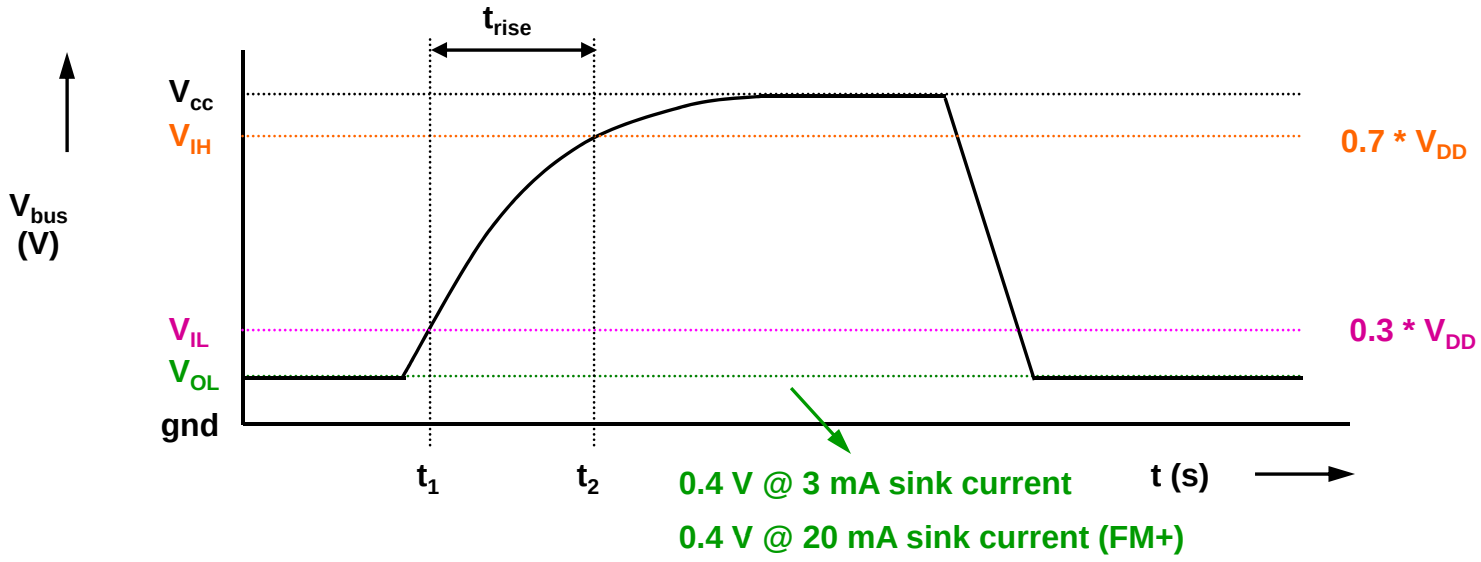
	Standard Mode	Fast Mode	Fast Mode Plus (FM+)	High Speed Mode	
Bitrate (kBit/s)	0 – 100	0 – 400	0 – 1000	0 – 1700	0 – 3400
Address (bits)	7 (10)	7 (10)	7 (10)	7 (10)	7 (10)
Capacitive Bus Load (pF)	400	400	550	400	100
Sink current (mA)	3	3	20	3	3

- Fast mode Plus (FM+):
  - Increased bandwidth
  - Increased transmission distance (at reduced bandwidth: >> 550 pF bus load)

I²C - Protocol

Modes: Electrical specification

	Standard Mode	Fast Mode	Fast Mode Plus (FM+)	High Speed Mode	
Bitrate (kBit/s)	0 – 100	0 – 400	0 – 1000	0 – 1700	0 – 3400
Address (bits)	7 (10)	7 (10)	7 (10)	7 (10)	7 (10)
Capacitive Bus Load (pF)	400	400	4000	400	100
Sink current (mA)	3	3	20	3	3
Trise: Rise time (ns)	1000	300	120	160	80



I²C - Protocol

Electrical: V_{DD} / How to calculate the pull-up resistor values

- V_{DD}voltage can be chosen freely
- Pull-up resistor value:
  - Minimum resistor value:
    - Determined by the I²C spec limit of 3 mA sinking current
    - $R = (V_{DDmax} – V_{olmax})/ 0.003A$
    - Example: using a V_{DD} = 5 ± 0.5 V: $R_{pull-up}$ = (5.5 V – 0.4 V) / 0.003 A = 1.7 kΩ
  - Maximum resistor value:
    - Determined by the I²C-bus rise time requirements:

      $V(t_1) = 0.3 * V_{DD} = V_{DD} (1 – 1/e^{t1/RC})$; then $t_1 = 0.3566749 * RC$

      $V(t_2) = 0.7 * V_{DD} = V_{DD} (1 – 1/e^{t2/RC})$; then $t_2 = 1.2039729 * RC$

      $t = t_2 – t_1 = 0.8472979 * RC$
    - For standard-mode I²C-bus: t_{rise} = 1000 ns (1 µs)

      so RC = 1180.2 ns
    - Example: at a bus load of 400 pF: R_{max}= 2.95 kΩ
    - For Fast-Mode: I²C-bus rise time = 300 ns @ 400 pF: R_{max}= 885 Ω

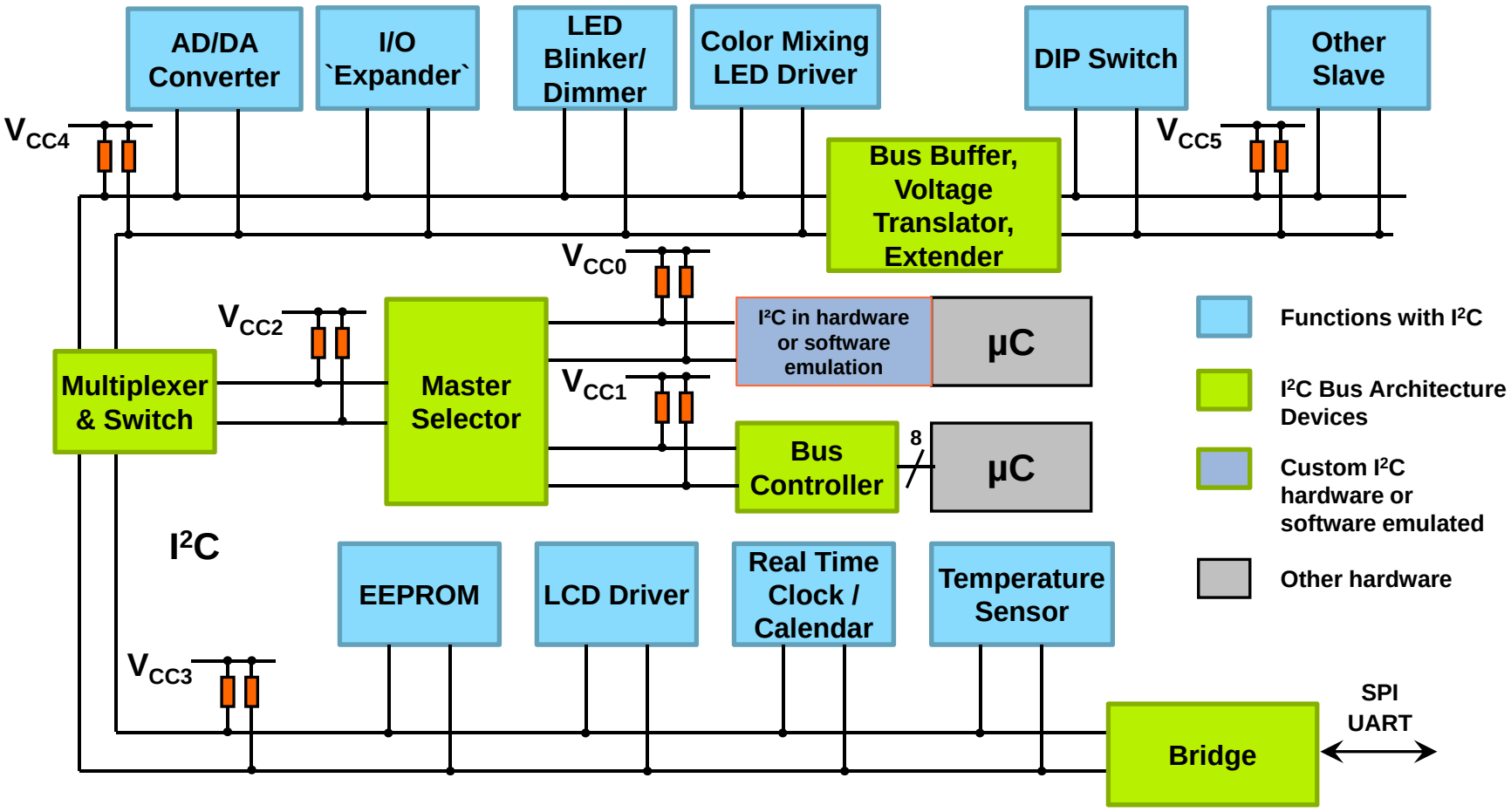
I²C - Protocol

Summary

START	HIGH to LOW transition on SDA while SCL is HIGH
STOP	LOW to HIGH transition on SDA while SCL is HIGH
DATA	8-bit word, MSB first (Address, Control, Data): - Must be stable when SCL is HIGH - Can change only when SCL is LOW - Number of bytes transmitted is unrestricted
ACKNOWLEDGE	- Done on each 9th clock pulse during the HIGH period - The transmitter releases the bus - SDA goes HIGH - The receiver pulls DOWN the bus line - SDA goes LOW
CLOCK	- Generated by the Master(s) - Maximum speed: (100, 400, 1000, 3400 kHz) but NO min - A receiver can hold SCL low when performing another function (transmitter in a Wait state) - A master can slow down the clock for slow devices
ARBITRATION	- Master can start a transfer only if the bus is free - Several masters can start a transfer at the same time - Arbitration is done on SDA line - Master that lost the arbitration must stop sending data

I²C-bus Applications

I²C-bus Building Blocks



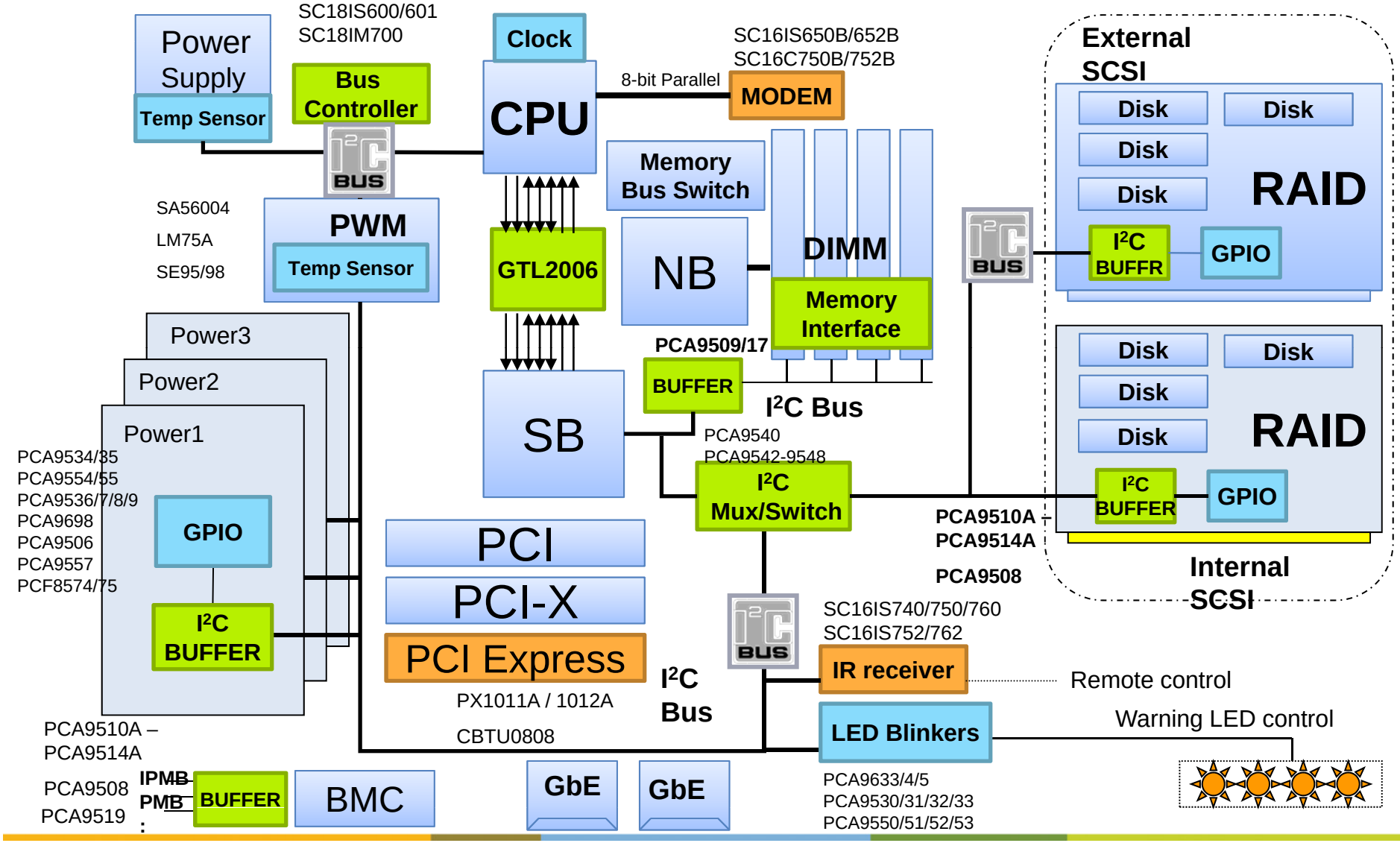
Market Application Segments

- Computing
- Communication
- Industrial
- Mobile
- Gaming/LED Sign

Application: Computing

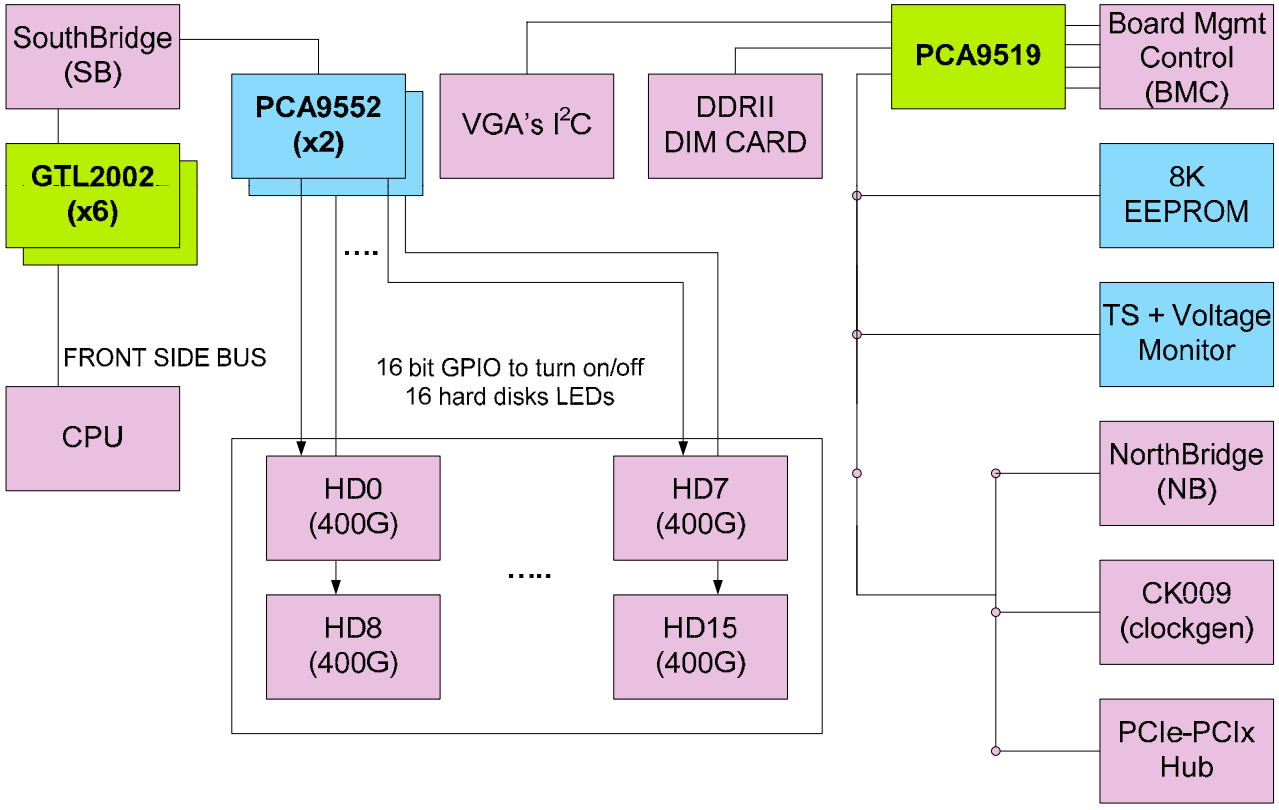
- Server/IPMI
- Storage Server
- BMC
- Fan Control
- Power Supply
- Voltage Translation

Server/IPMI

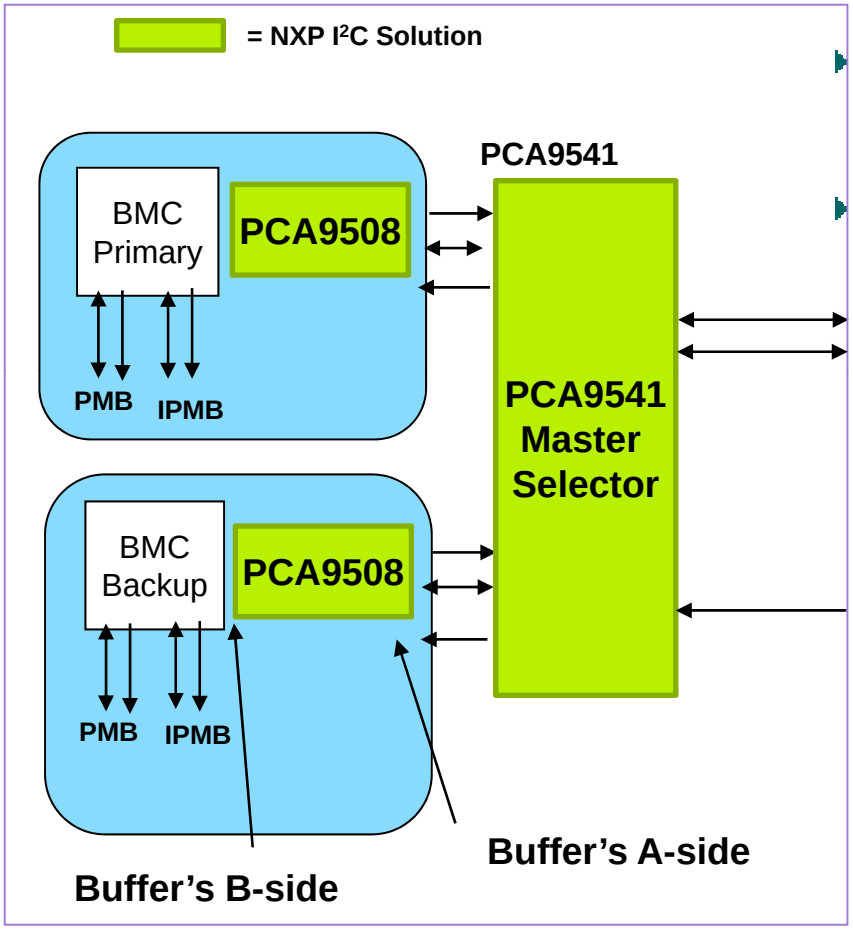

Power Supply
Temp Sensor
SC18IS600/601
SC18IM700
Bus Controller
Clock
CPU
8-bit Parallel
SC16IS650B/652B
SC16C750B/752B
MODEM
External SCSI
Disk
Disk
Disk
Disk
RAID
I²C BUFFR
GPIO
I²C BUS
Memory Bus Switch
DIMM
Memory Interface
SA56004
LM75A
SE95/98
PWM
Temp Sensor
GTL2006
NB
PCA9509/17
BUFFER
I²C Bus
Power3
Power2
Power1
SB
PCA9534/35
PCA9554/55
PCA9536/7/8/9
PCA9698
PCA9506
PCA9557
PCF8574/75
GPIO
I²C BUFFER
PCA9540
PCA9542-9548
I²C Mux/Switch
PCA9510A –
PCA9514A
PCA9508
Internal SCSI
PCI
PCI-X
PCI Express
PX1011A / 1012A
CBTU0808
I²C Bus
SC16IS740/750/760
SC16IS752/762
IR receiver
Remote control
LED Blinkers
Warning LED control
PCA9510A –
PCA9514A
PCA9508
PCA9519
IPMB
PMB
BUFFER
BMC
GbE
GbE
PCA9633/4/5
PCA9530/31/32/33
PCA9550/51/52/53

Storage Server Block Diagram

- PCA9519 performs level translation for BMC's I^2C ports
- PCA9552 collects hard drive interrupts and turns on/off LEDs

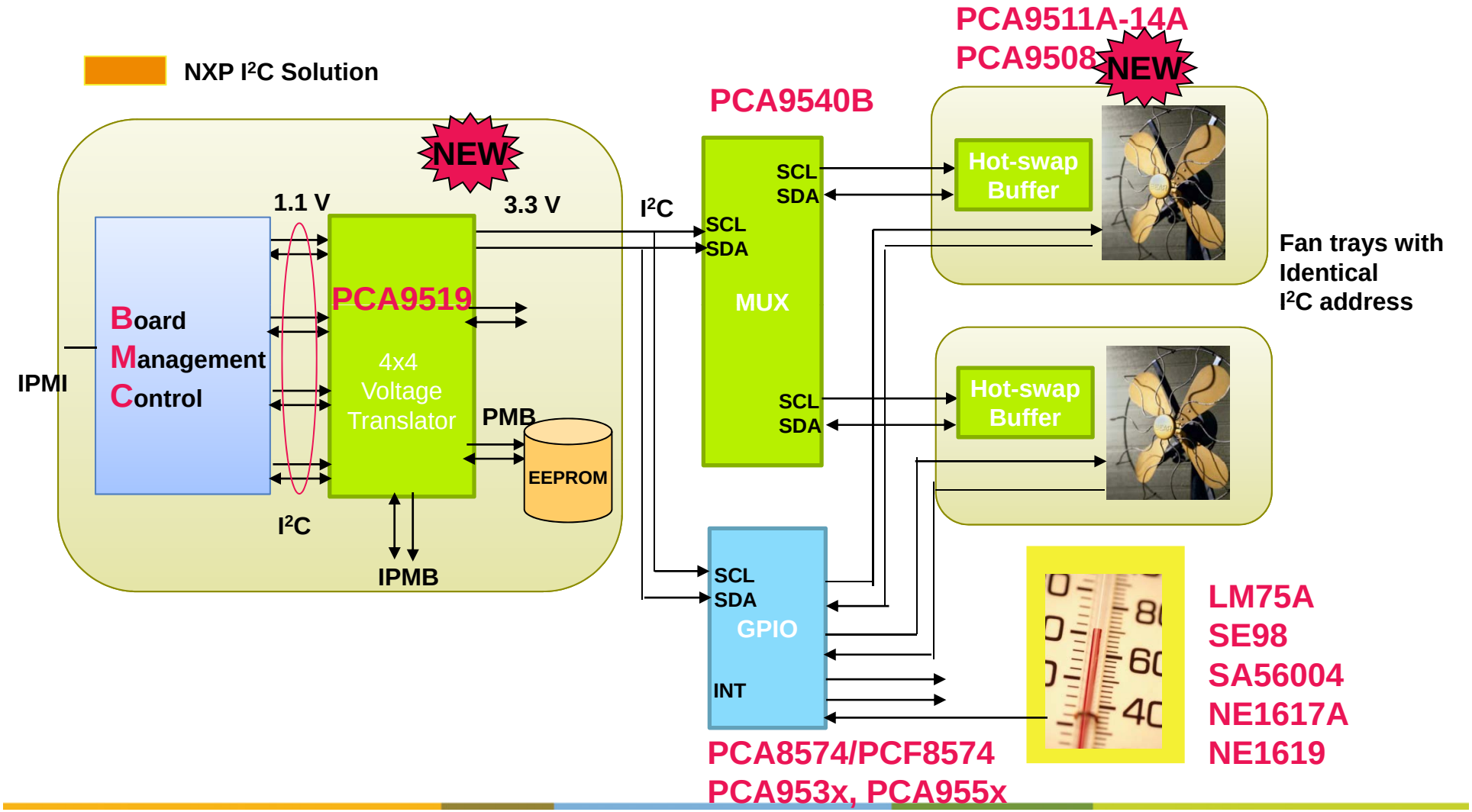


Redundant BMC Implementation



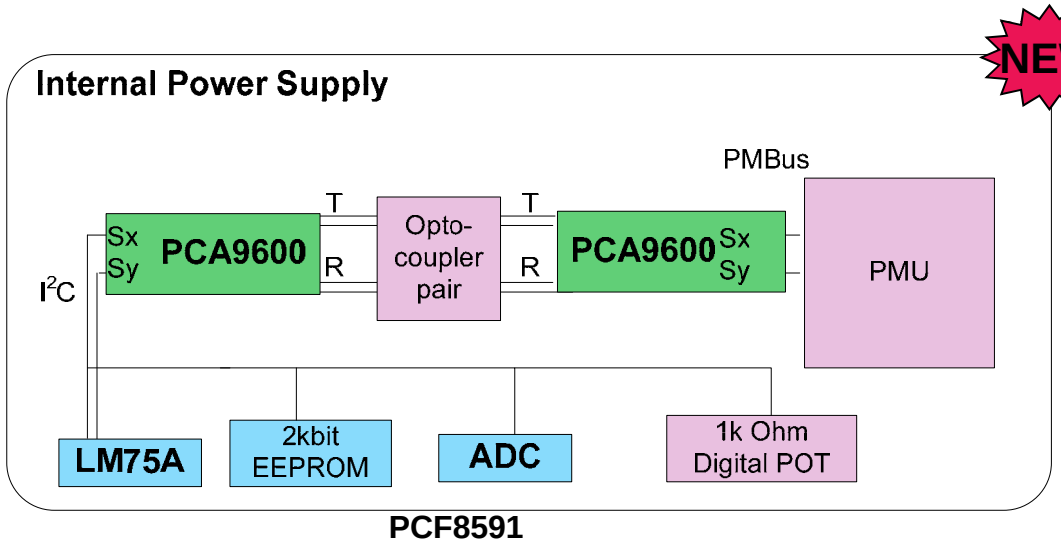
- PCA9541 selects between a primary and redundant BMC masters
- PCA9508 is hot-swap bus buffer without offset on A-side, enables each BMC card to hot-swap without data corruption

Temperature and Fan Control in IPMI



Internal Power Supply

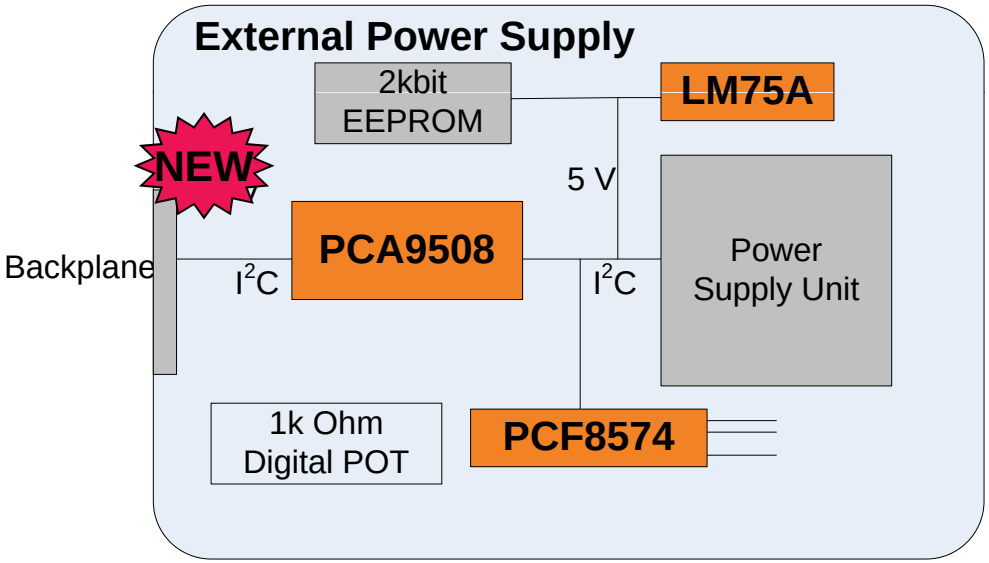
- Problem: Power supply requires 1.5 kV isolation on PMBus
- Solution: Opto-coupler is required – and P82B96 or PCA9600, bus extender converts opto-coupler electrical transmit/receive signals to I^2C and PMBUS



NEW

PCA9600 is 1 MHz With improved voltage threshold on Sx/Sy side over P82B96

Hot-Swap External Power Supply



= NXP I²C Solution

Hot-swap Buffer

PCA9508
PCA9512A

I/O Expander

PCA8574/PCF8574
PCA953x
PCA955x

Temp Sensor

LM75A
SE97
SA56004
NE1617A

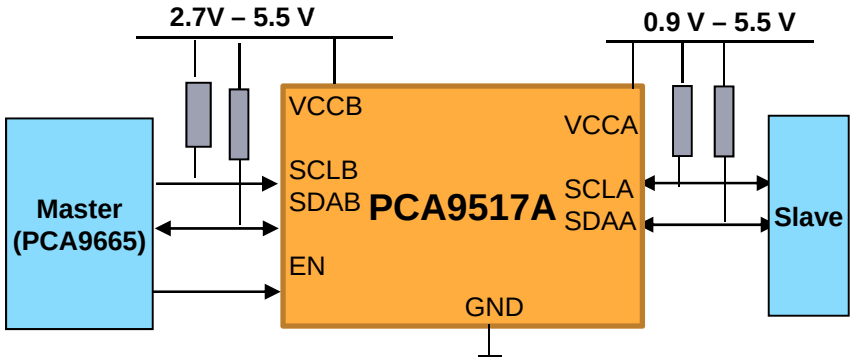
I²C-busVoltage Translator

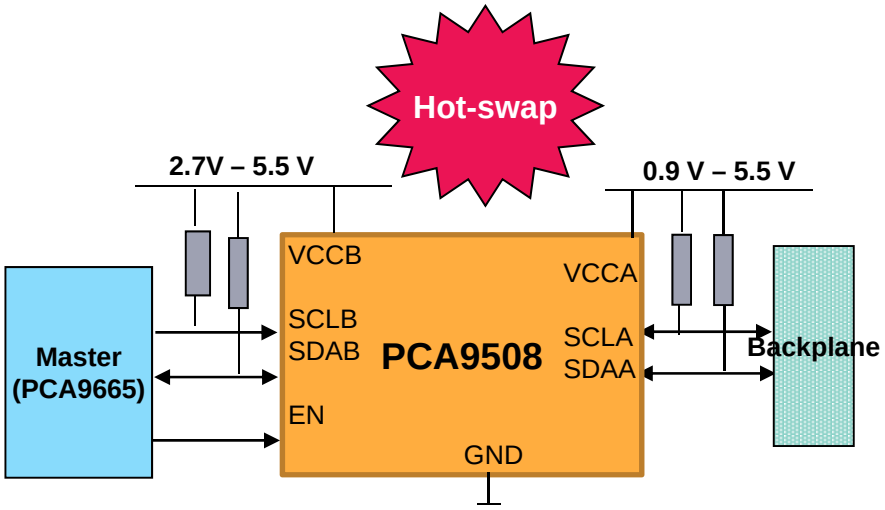
Features

- Capacitance/noise isolation
- Voltage Translation
  - A-side: 0.9 V to 5.5 V
  - B-side: 2.7 V to 5.5 V
- TTL compatible I/O
- High drive offset free A-side (6mA)

Applications

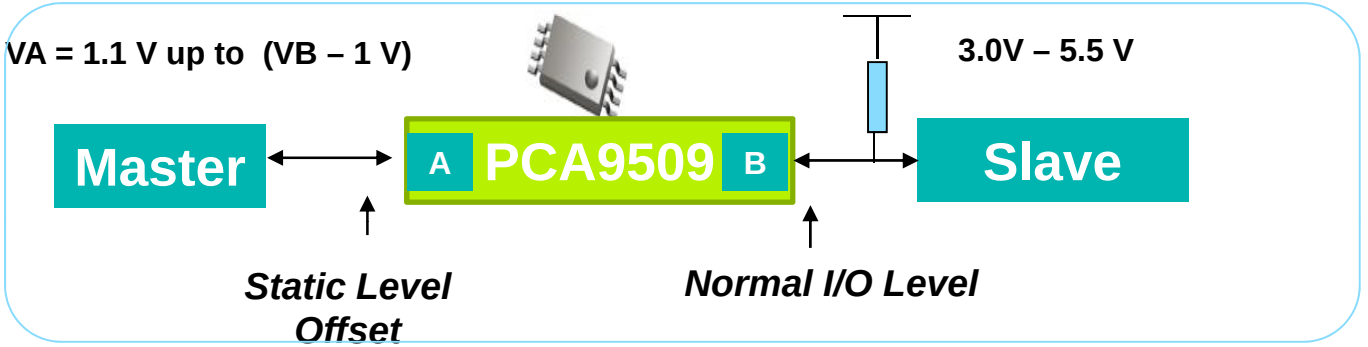
- Telecom
- Storage
- Computing
- Switching Power Supply



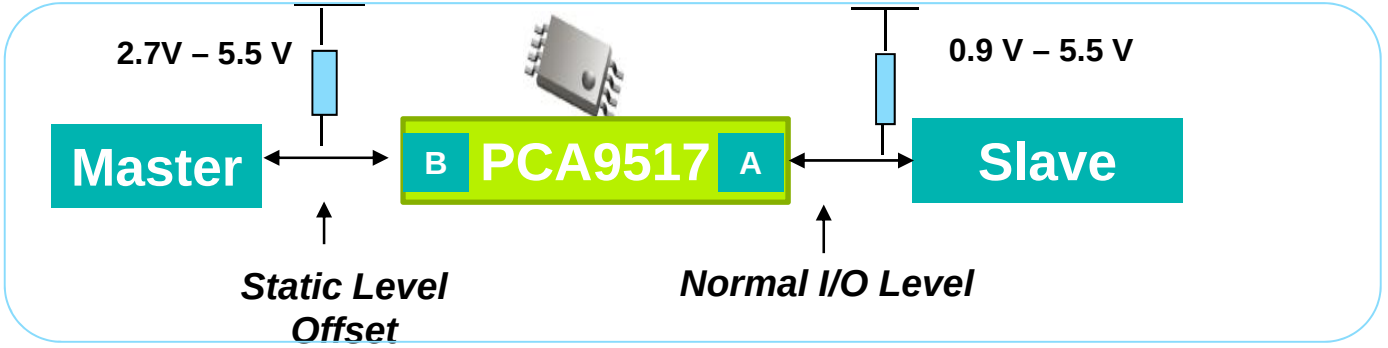


Voltage Translation for Low Voltage Master or Slave

1. Low Voltage Master



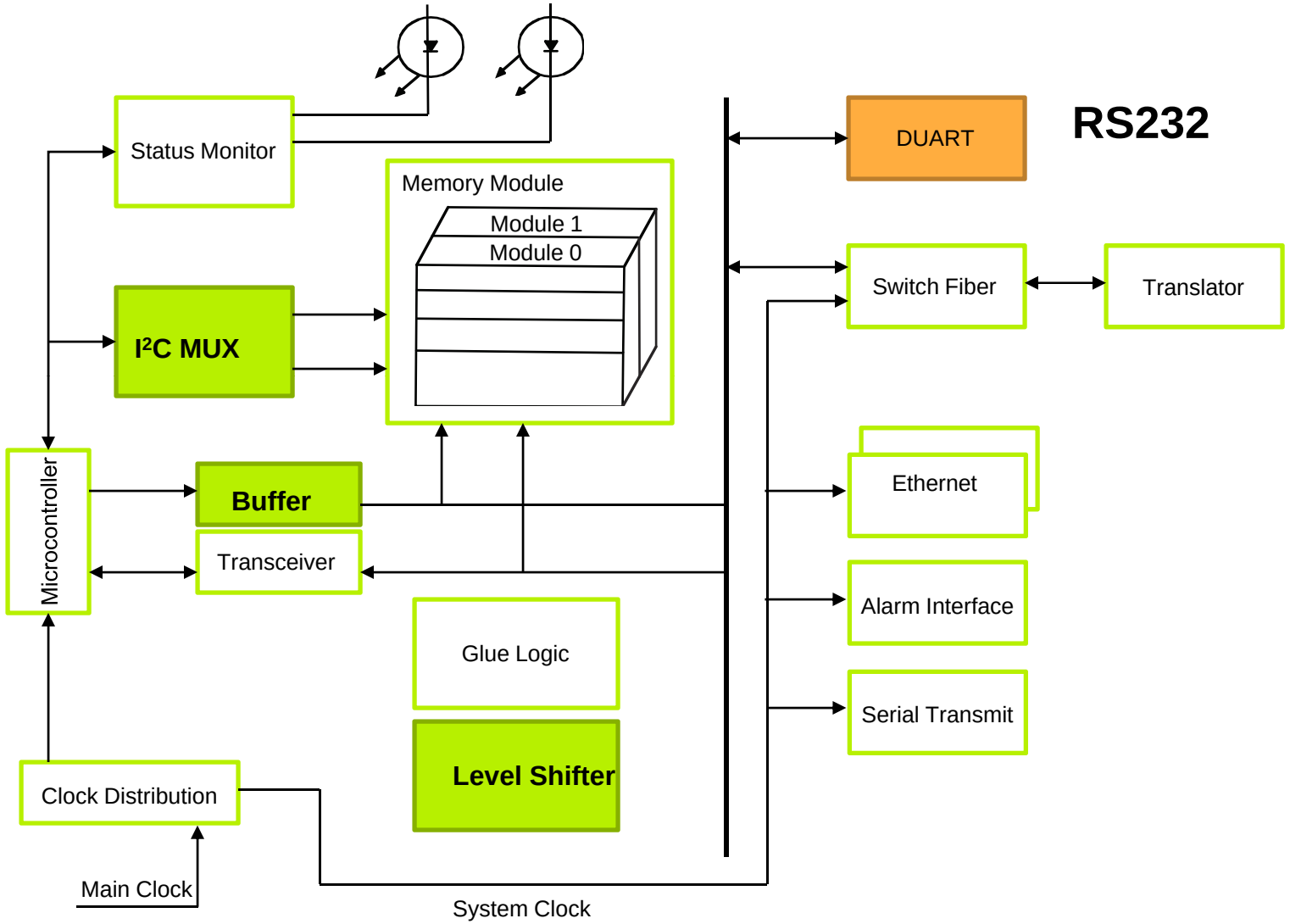
2. Low Voltage Slave



Application: Communications

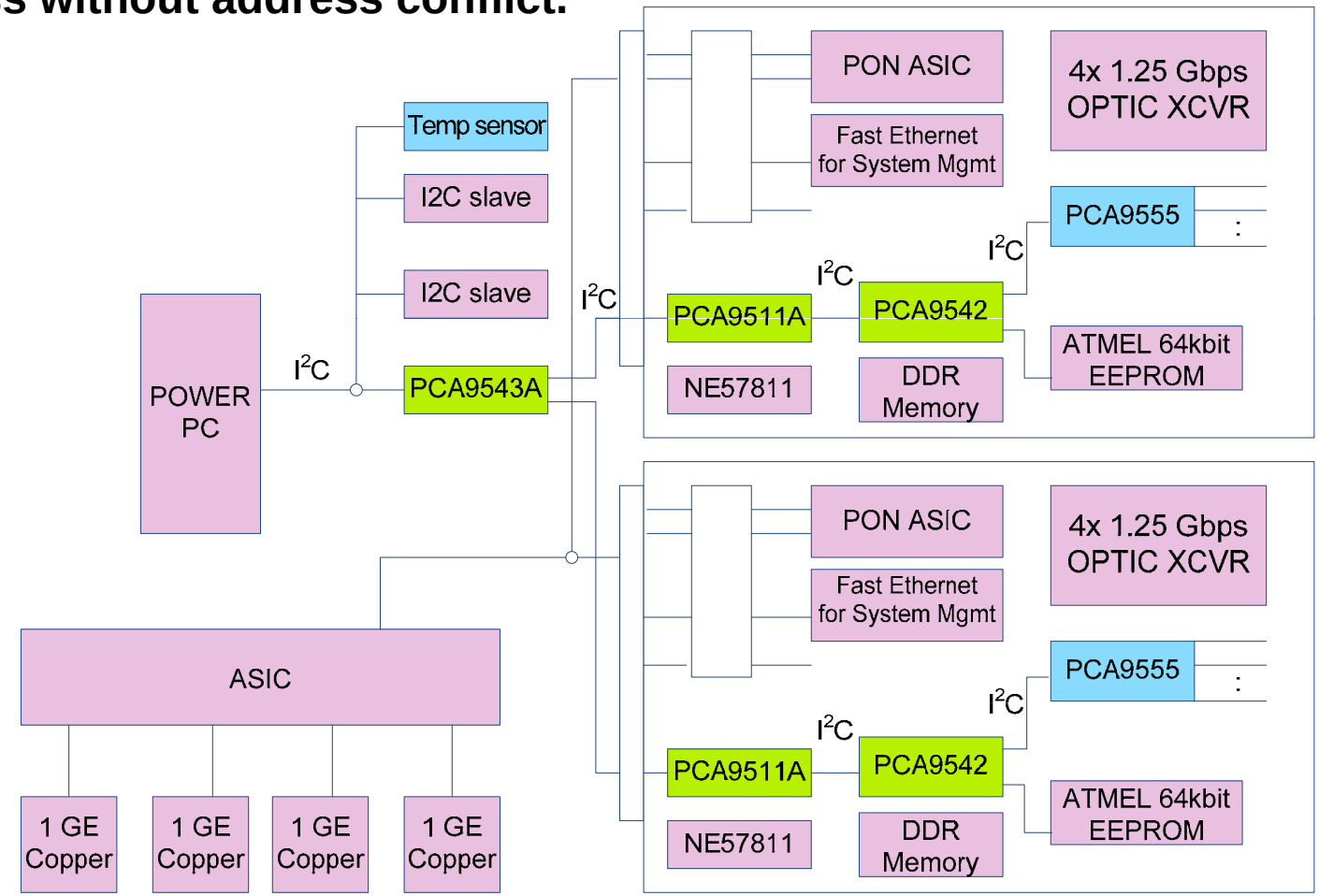
- Networking Line Card
- GPON
- Router
- AdvancedTCA

Networking Line Card



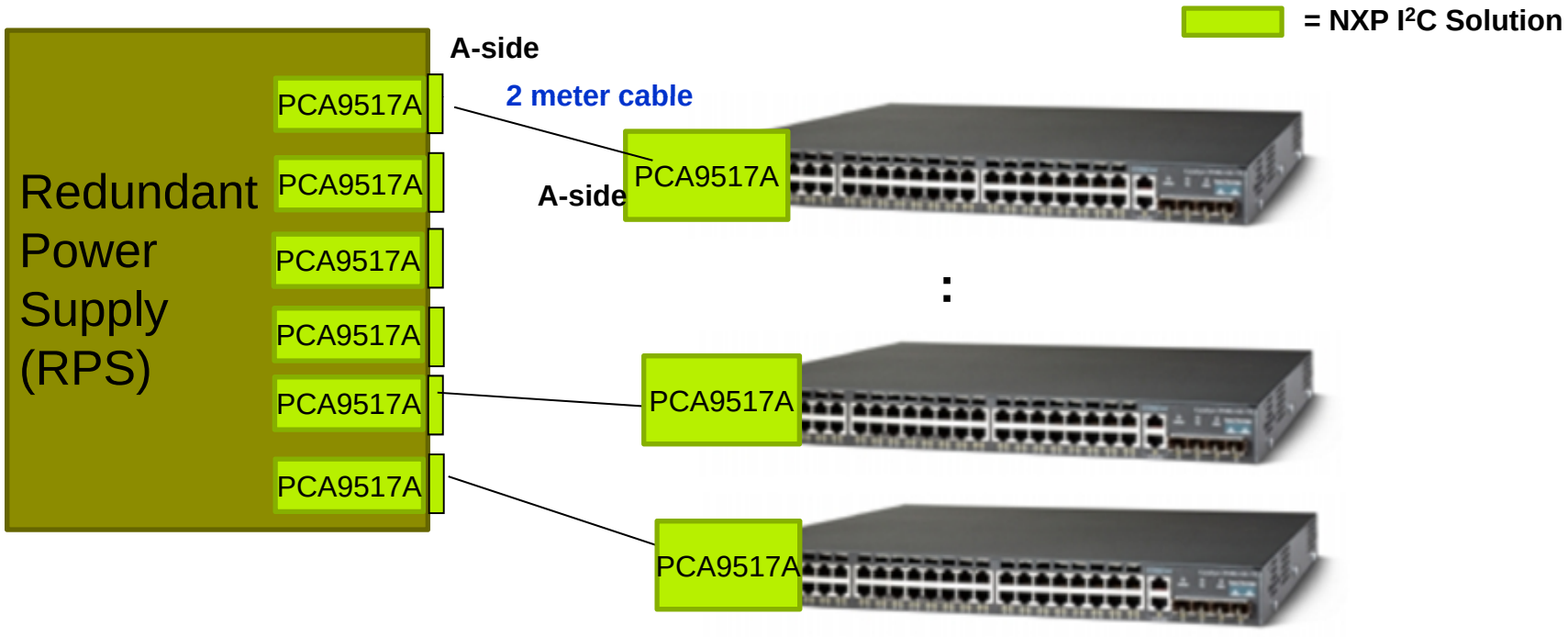
GigE over Passive Optical Network (GPON)

- **PCA9543A allows easy plug-in for 2 line cards having the same I2C address without address conflict.**



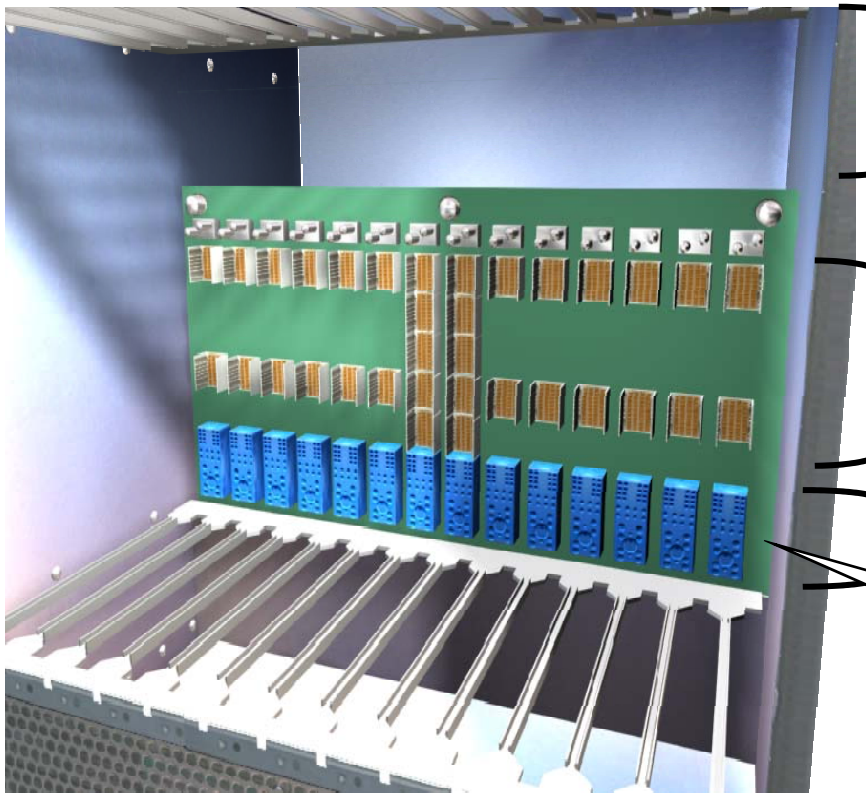
I²C Buffer for Box-to-Box Communication

- Problem: Box-to-box uses more expensive connectivity solution
- Solution: I²C buffer, PCA9517A, is a cost effective solution and operate up to 400kHz



Advanced TCA Basic

- PICMG: PCI Industrial Computer Manufacturers Group
  - Specifications body (700+ members) www.picmg.org
  - AdvancedTCA is the name for PICMG 3.x standards and programs



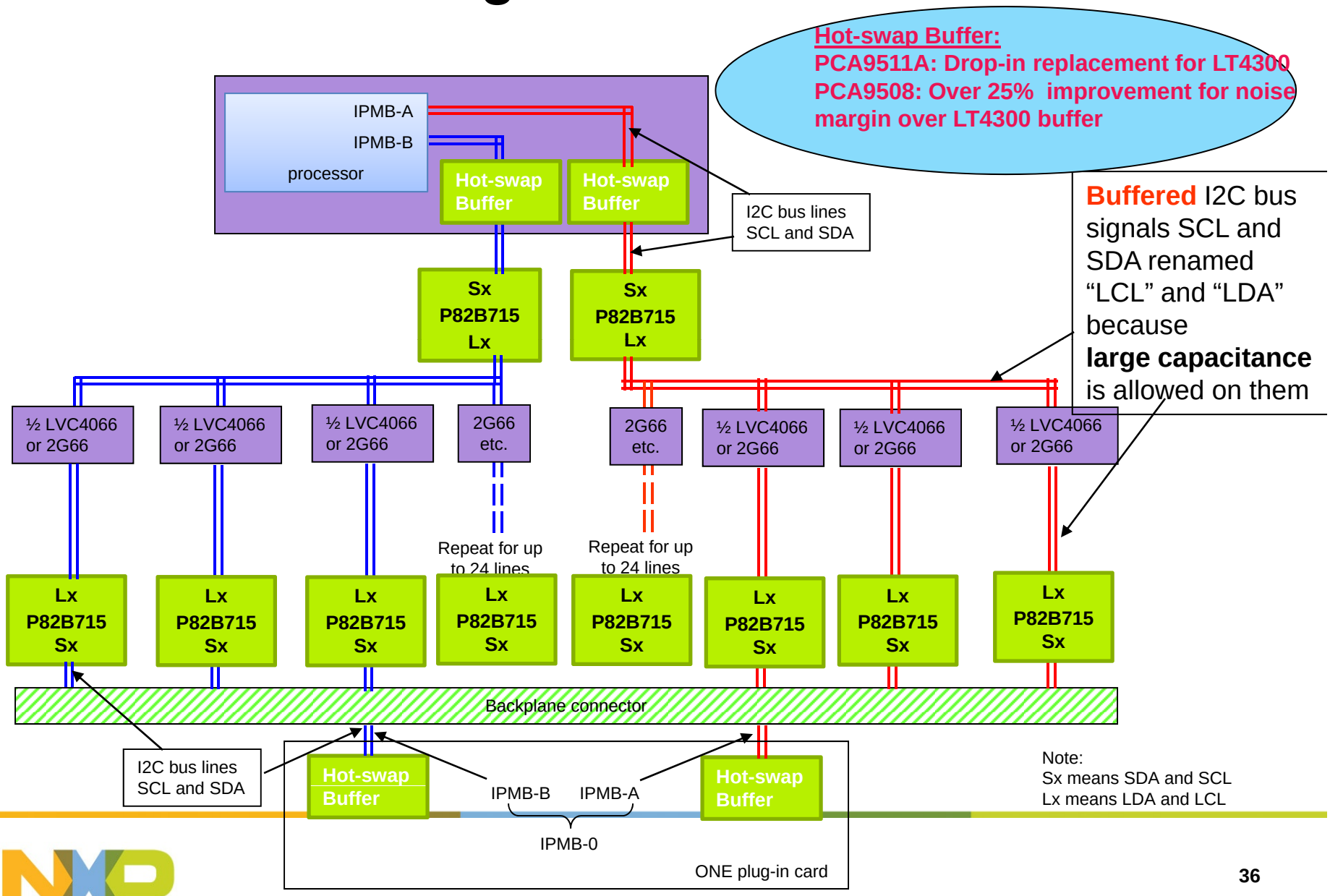
ZONE 3

ZONE 2

ZONE 1

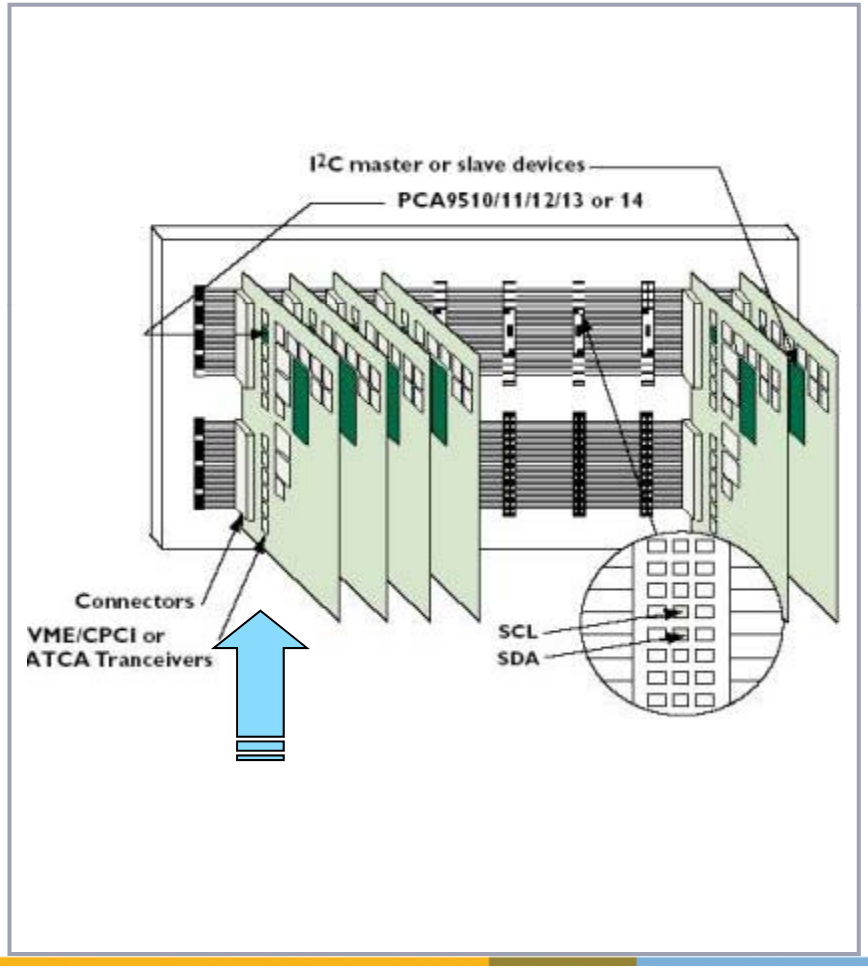
I²C is used for Management in Zone 1

ATCA Shelf Manager: IPMB-0



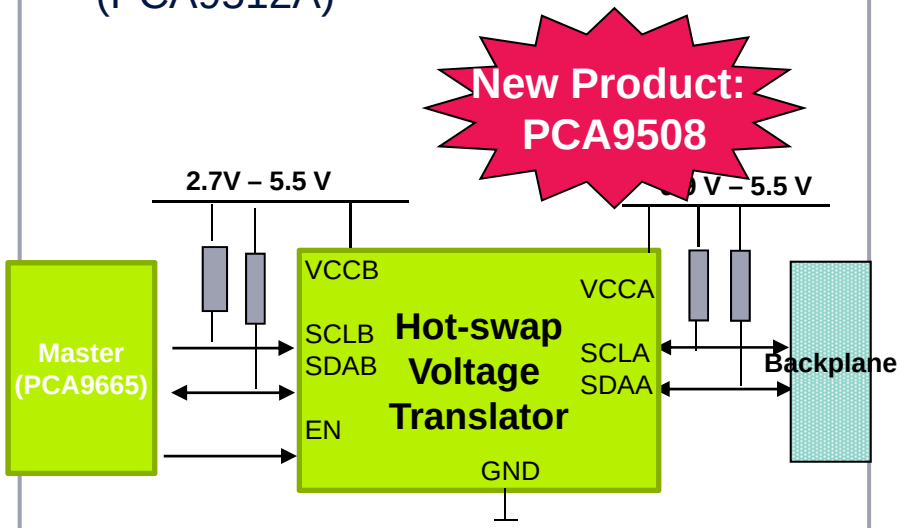
Voltage Translator with Hot-Swap for Modular Systems with I²C at Card Edge

- **PCA9512A – integrated rise time accelerator**
- **PCA9508A – No rise time accelerator and no offset**



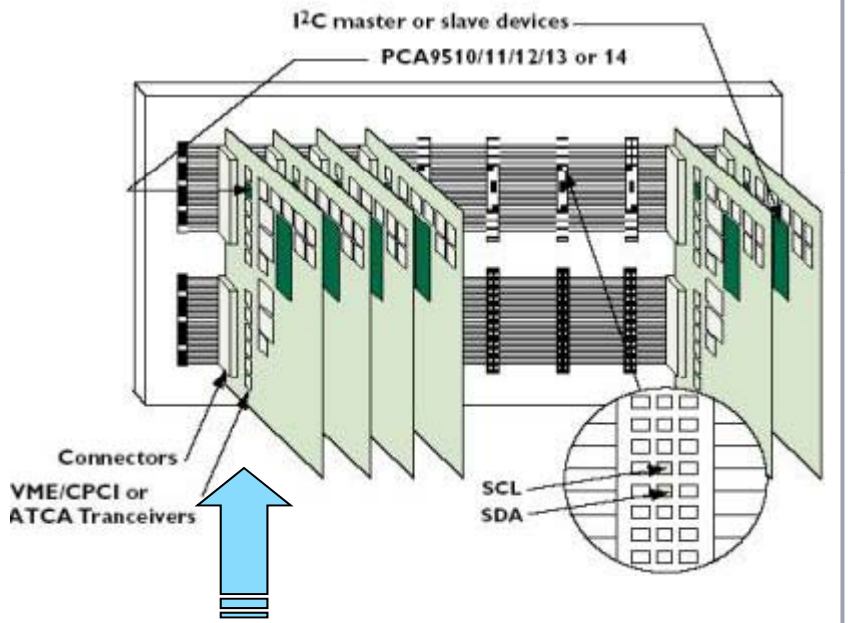
Features

- Integrated IDLE/STOP for hotswap support
- Integrated rise time accelerator
- Voltage translation support (PCA9512A)



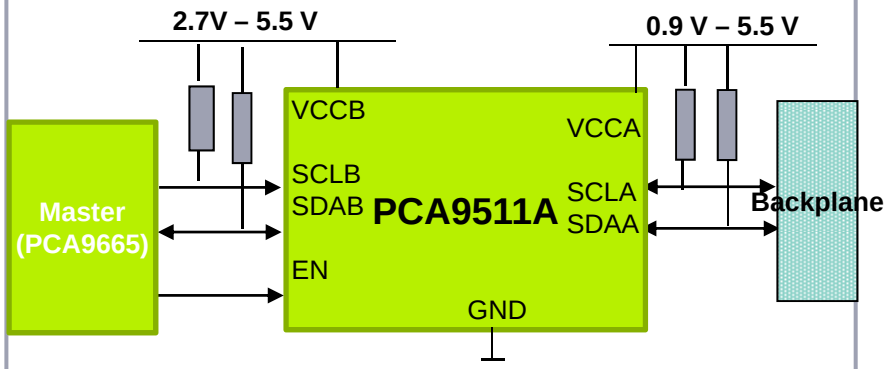
Hot-swap for Modular Systems with I²C at Card Edge

- **PCA9511A – 0.6 V threshold**
- **PCA9514A – 0.8 V threshold**



Features

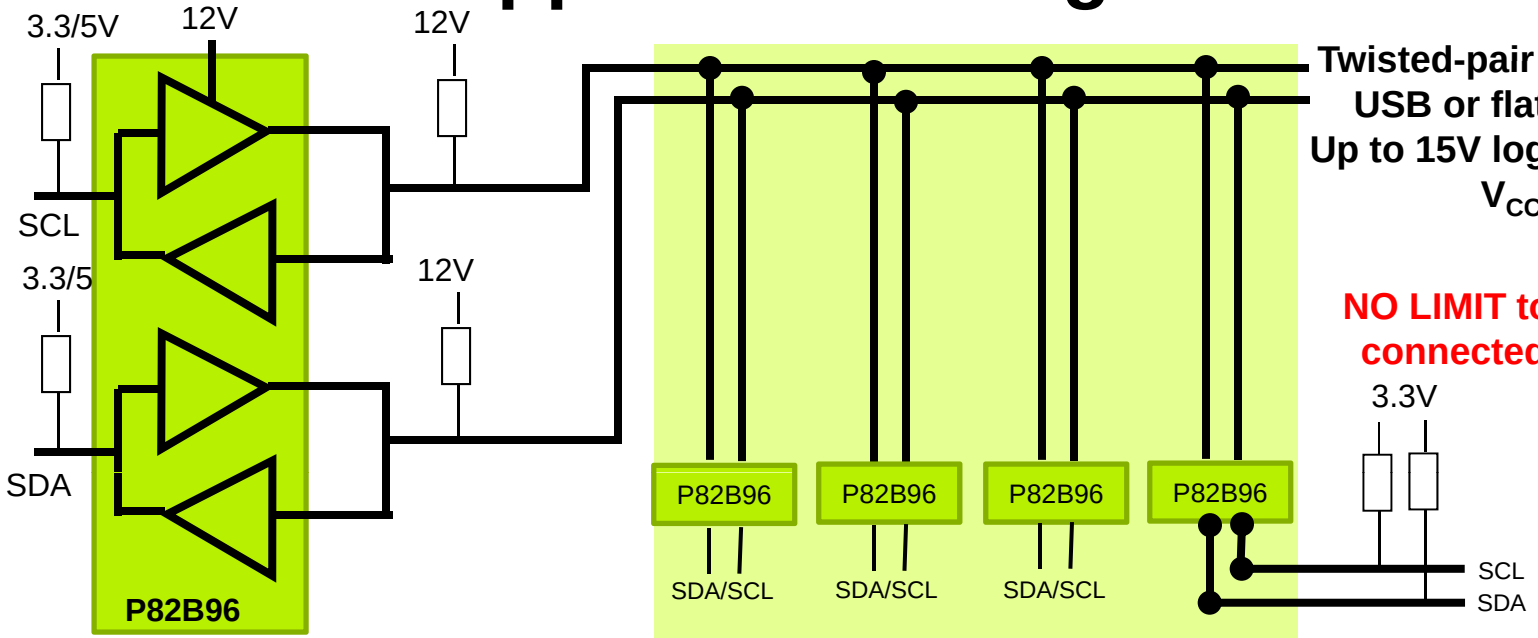
- Integrated IDLE/STOP for hotswap support
- Integrated rise time accelerator



Application: Industrial

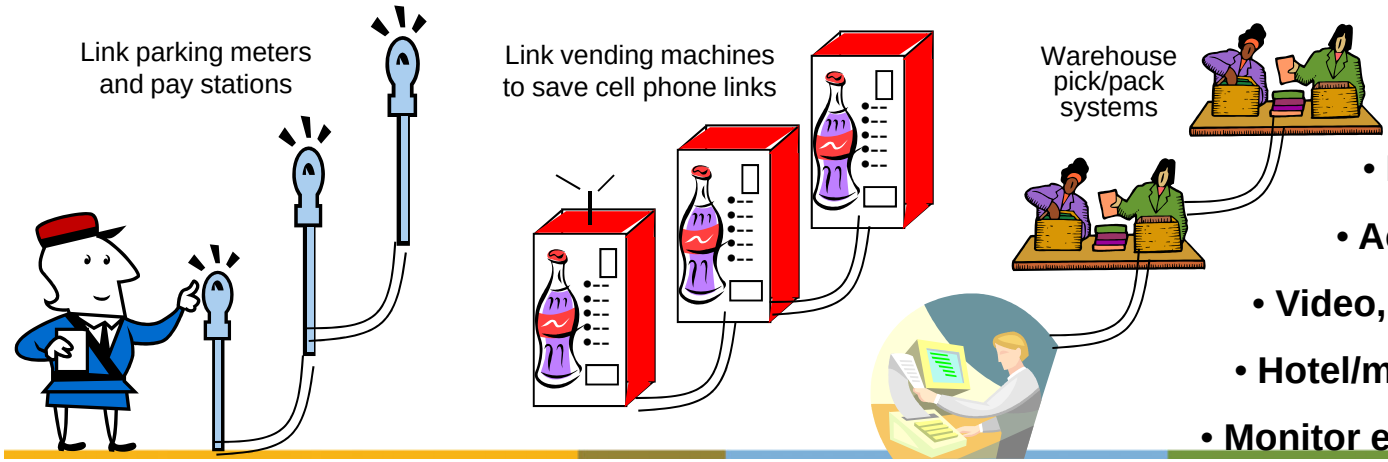
- Bus Buffers
- Bridges
- GPIO

Industrial Application using I²C bus Extender



Twisted-pair telephone wires, USB or flat ribbon cables Up to 15V logic levels, Include V_{CC} & GND

NO LIMIT to the number of connected bus devices !

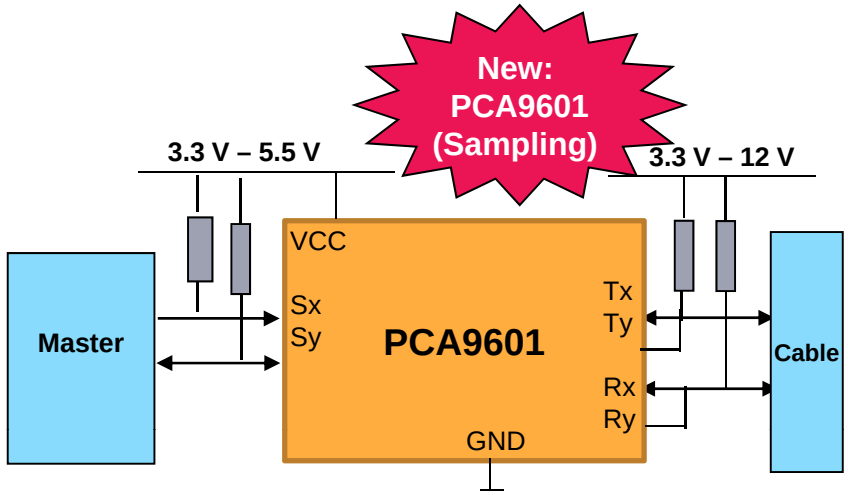


- **Factory automation**
- **Access/alarm systems**
- **Video, LCD & LED display signs**
- **Hotel/motel management systems**
- **Monitor emergency lighting/exit signs**

Long Distance I²C Communication in Noisy Environment

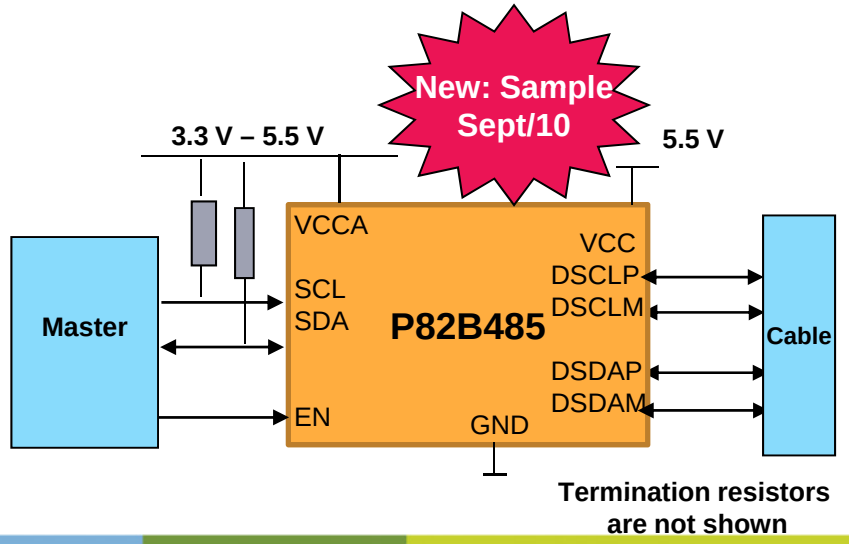
Single-ended I²C

- Capacitance/noise isolation
- TTL compatible I/O
- 12 V high drive offset free on T/R-side
- Seamless interface to opto-coupler



Differential I²C

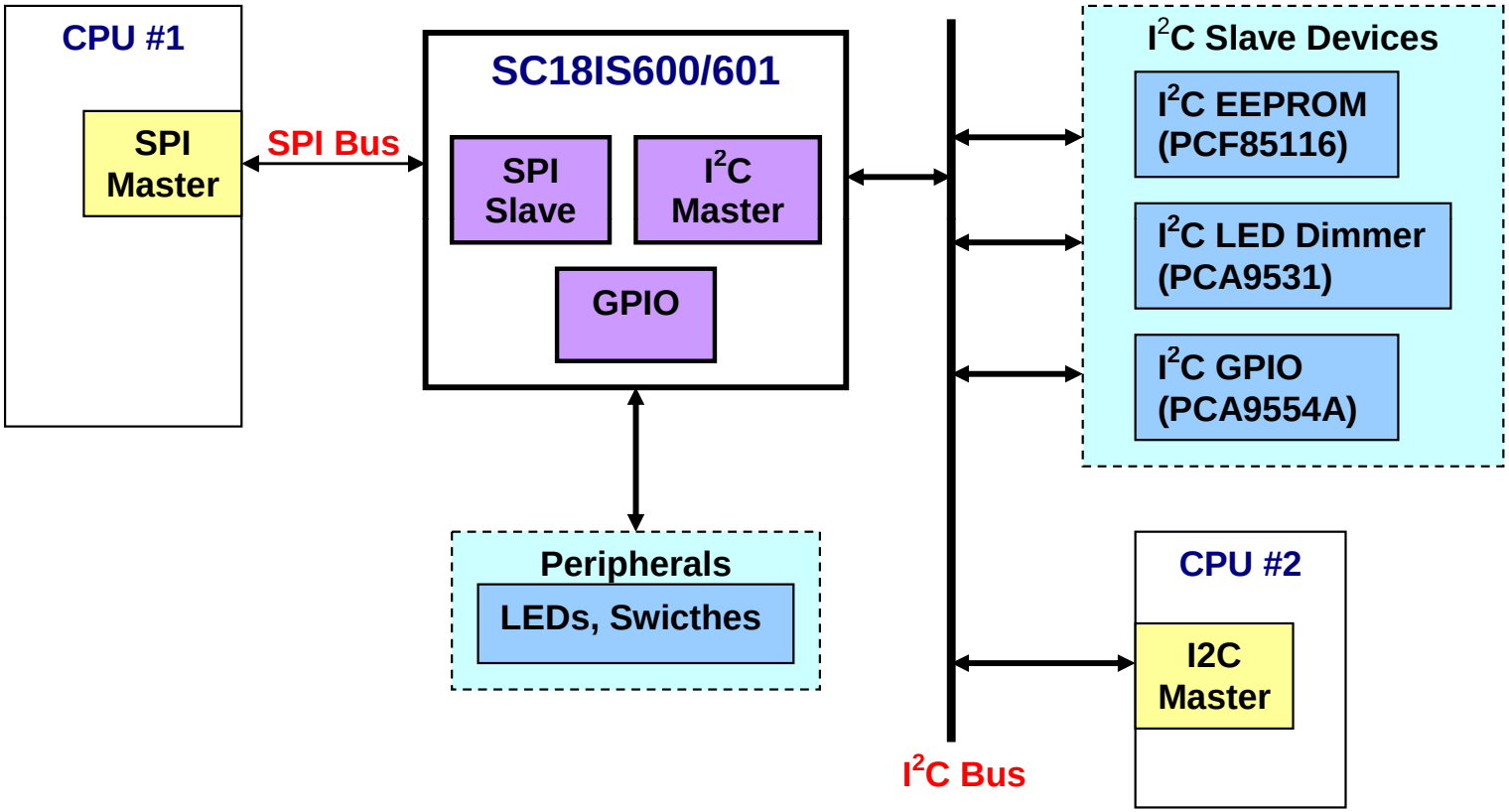
- Convert single-ended I²C to Differential I²C
- Low common mode noise voltage



Bridge Application example

BRIDGE
I2C

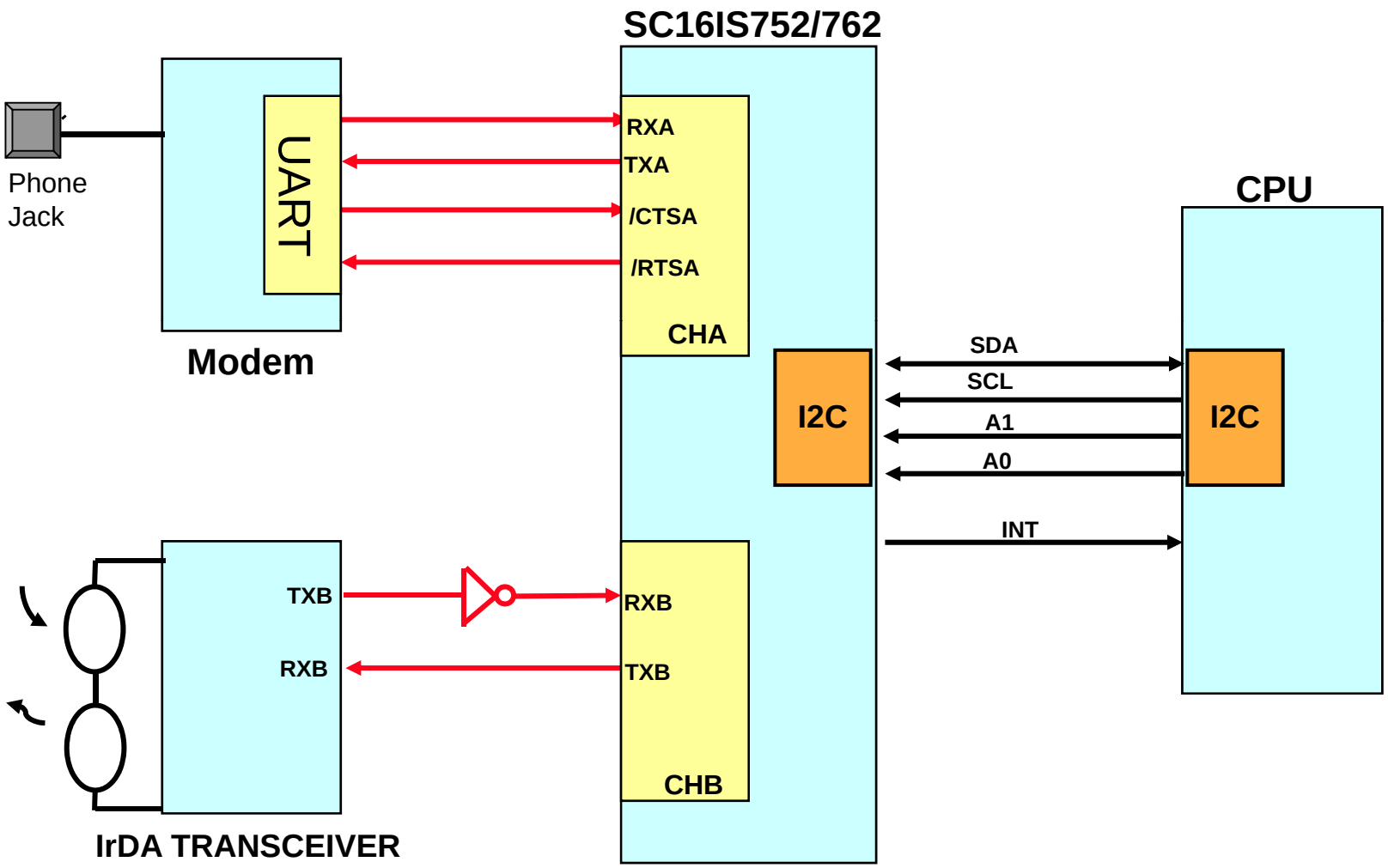
SPI CPU interface with the I2C devices



Bridge Application example

Bridge UART

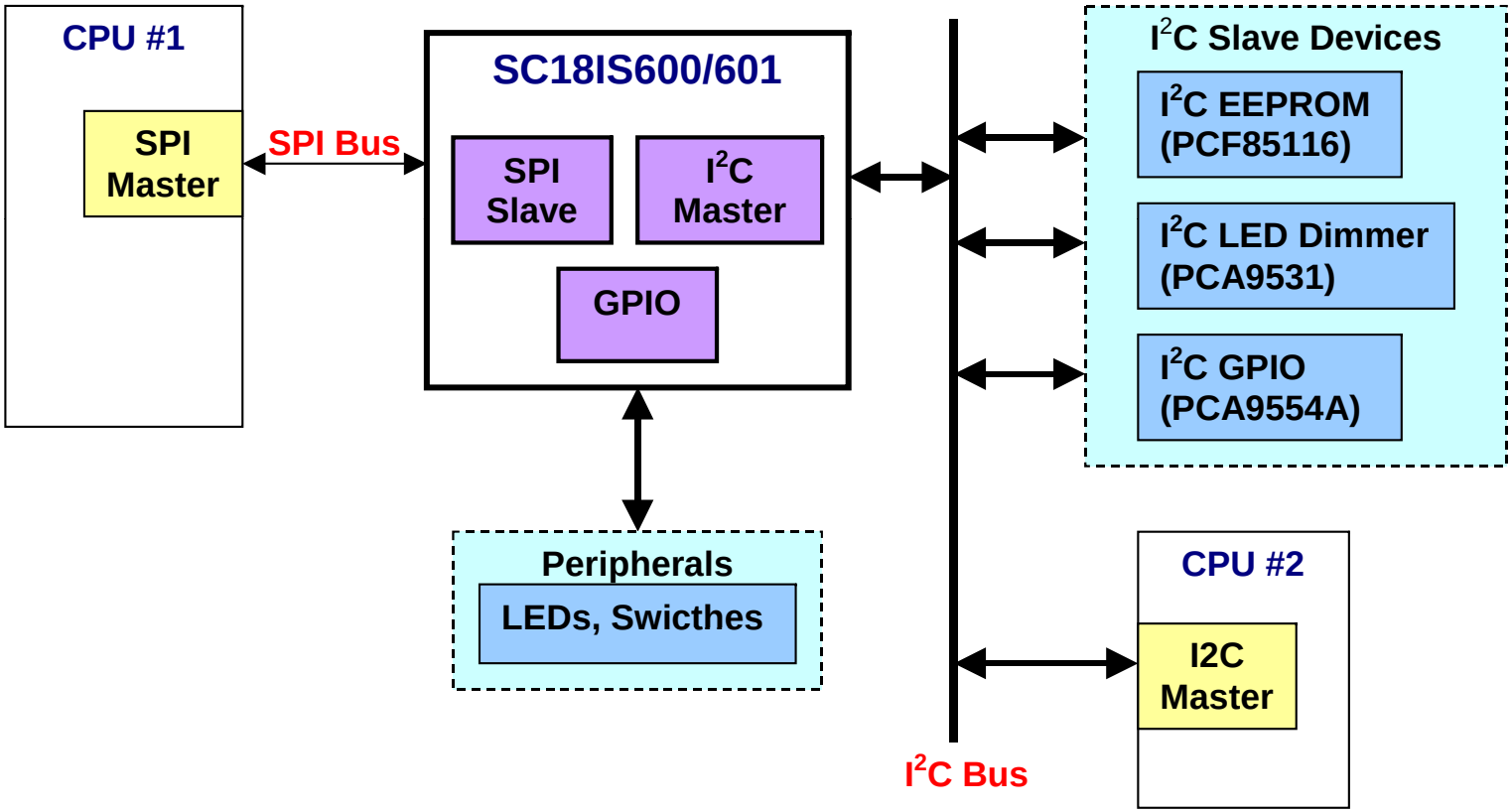
I2C CPU interface with Modem and IrDA



Bridge Application example

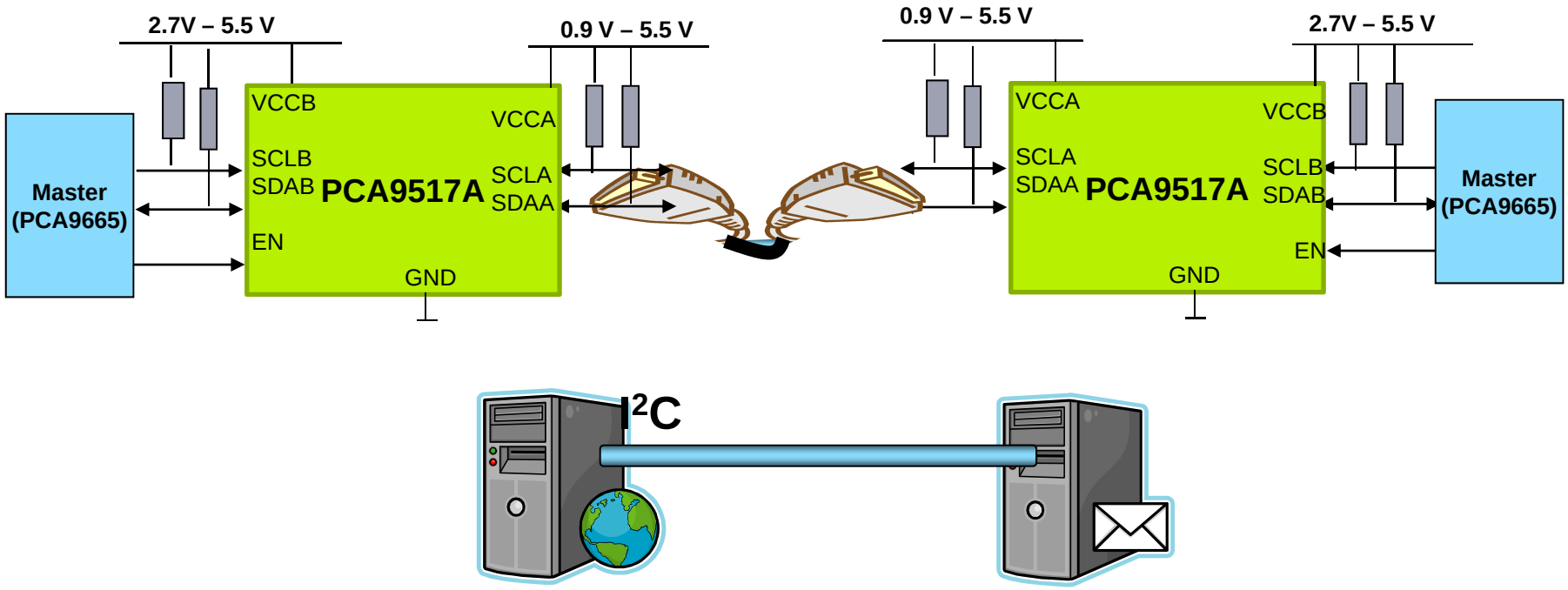
SPI CPU interface with the I2C devices

BRIDGE
I2C



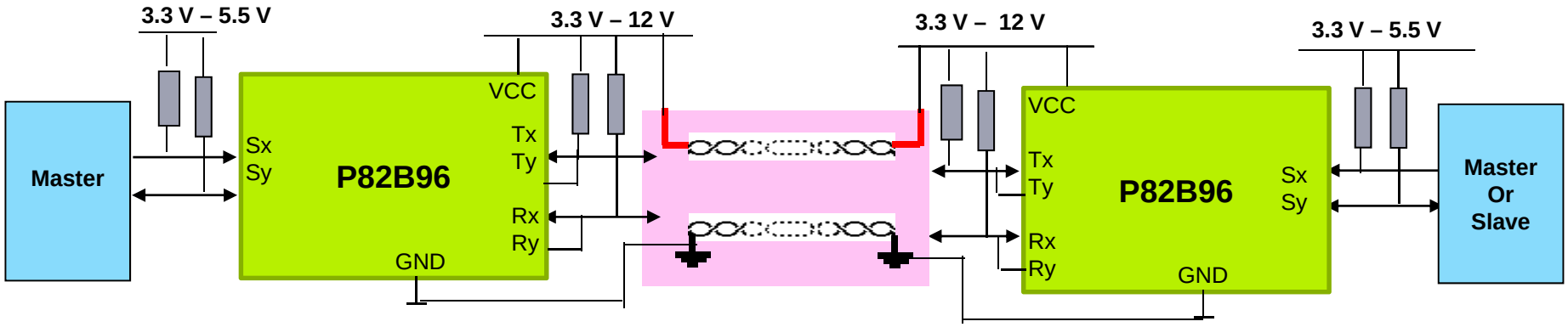
Bus Buffering for Complex Systems & “Out of the Box” Short Cable (5m) Connectivity

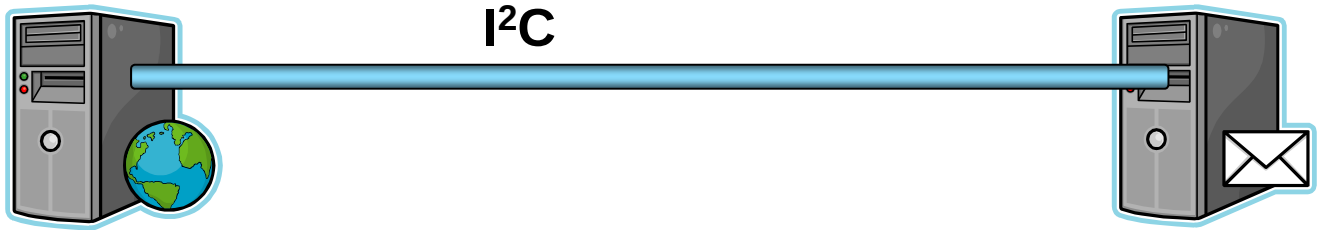
- Problem: For redundant server, system management through the use of other kind of connectivity is more costly and often unnecessary
- Solution: I²C-bus is a cost effective solution and allows bidirectional communication from 100kHz to 400 kHz – and with PCA9517A bus buffer, it is cheap and reliable



Bus Buffering for Complex Systems & “Out of the Box” Long Cable (> 1 km) Connectivity

- Problem: Driving > 1 km typically requires very expensive discrete components
- Solution: I²C-bus is a reliable, cost effective solution that allows bidirectional communication up to 100kHz – P82B96, PCA9600, PCA9601

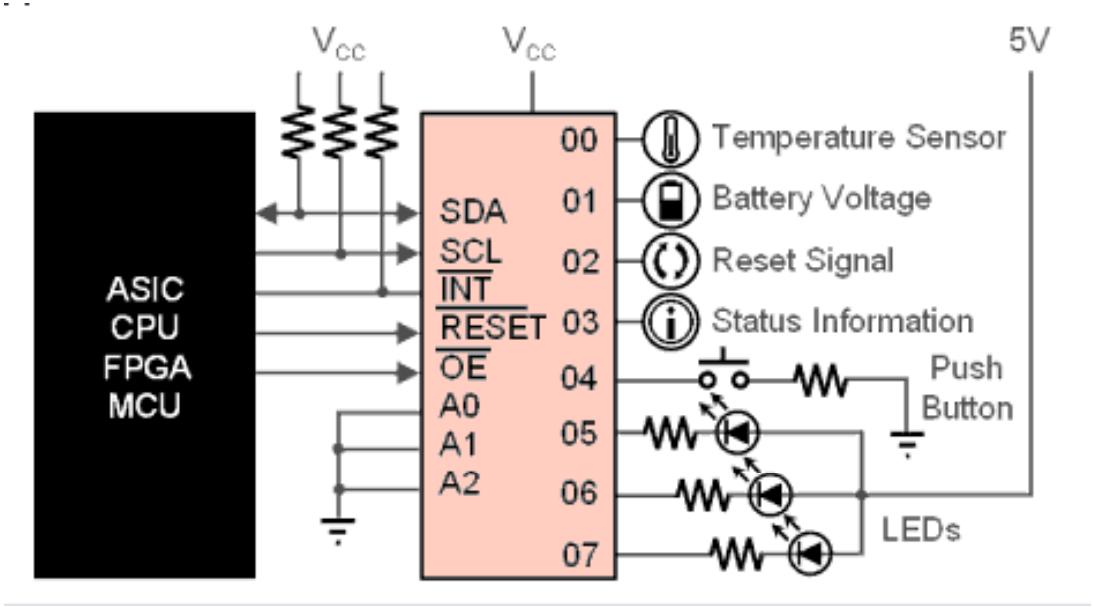




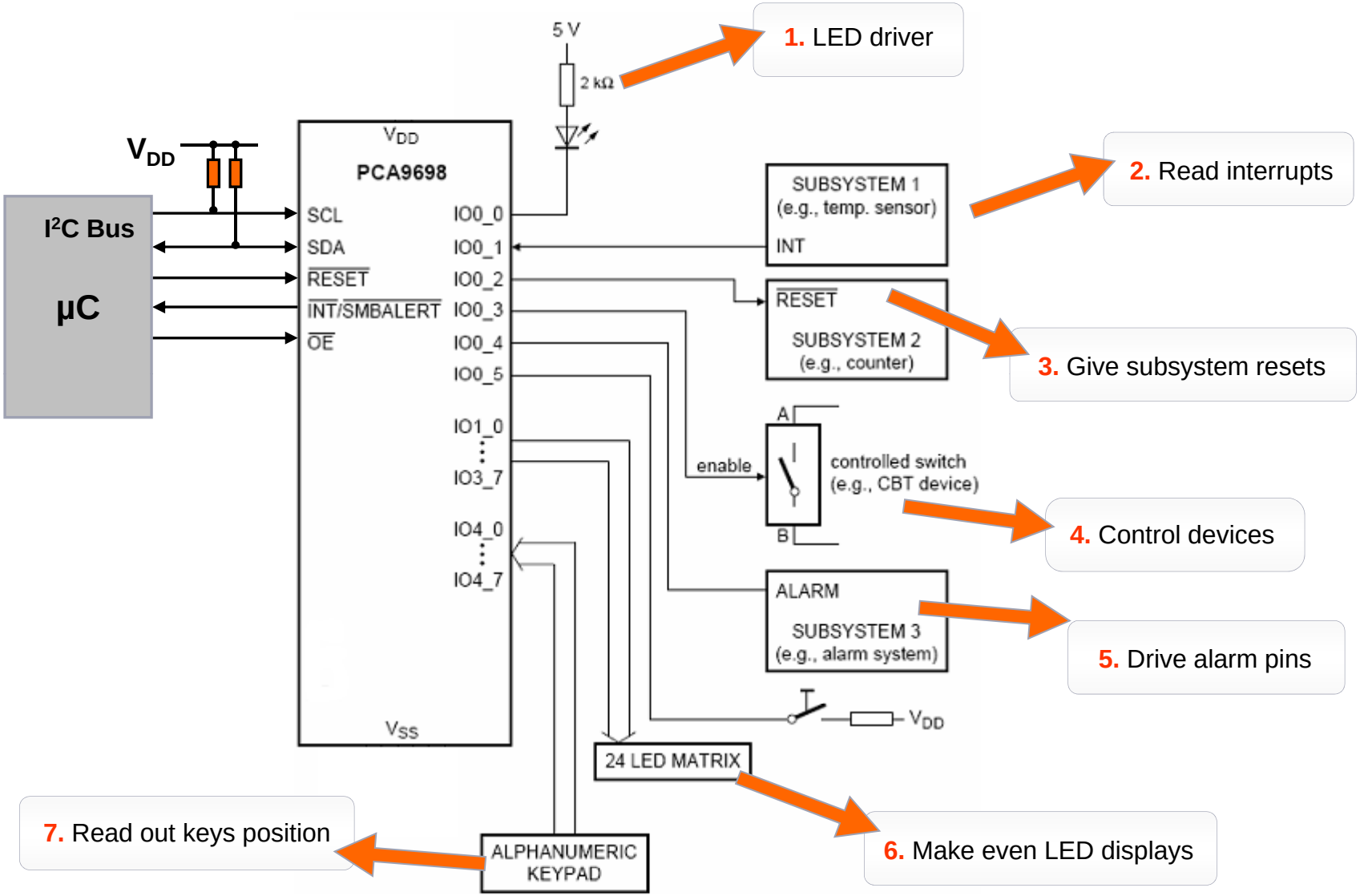
I²C-bus GPIO

Advantages
- Resolves I²C address conflicts
- Processor pin savings
- Improved board routing
- Reduced board space

Applications
- I²C bus isolation
- LED control
- Temperature sensing
- Fan control



I²C - GPIOs: General Purpose I/O Expanders

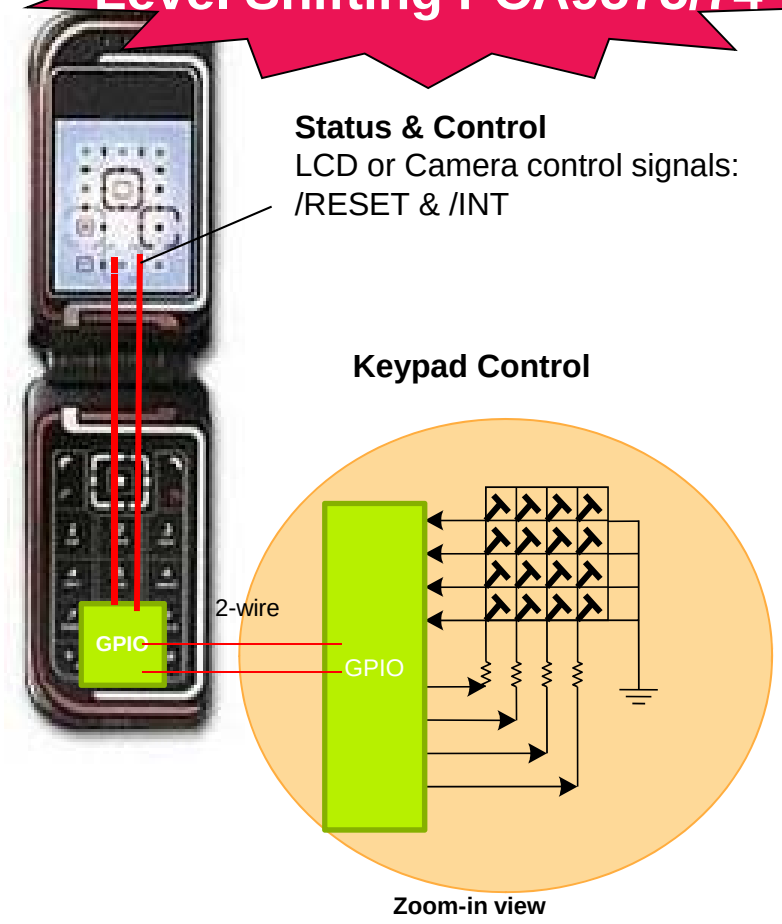


Application: Mobile

- GPIO
- LED control

Ultra Low-Voltage GPIOs Make Design Easier

New Dual Rail Level Shifting PCA9575/74



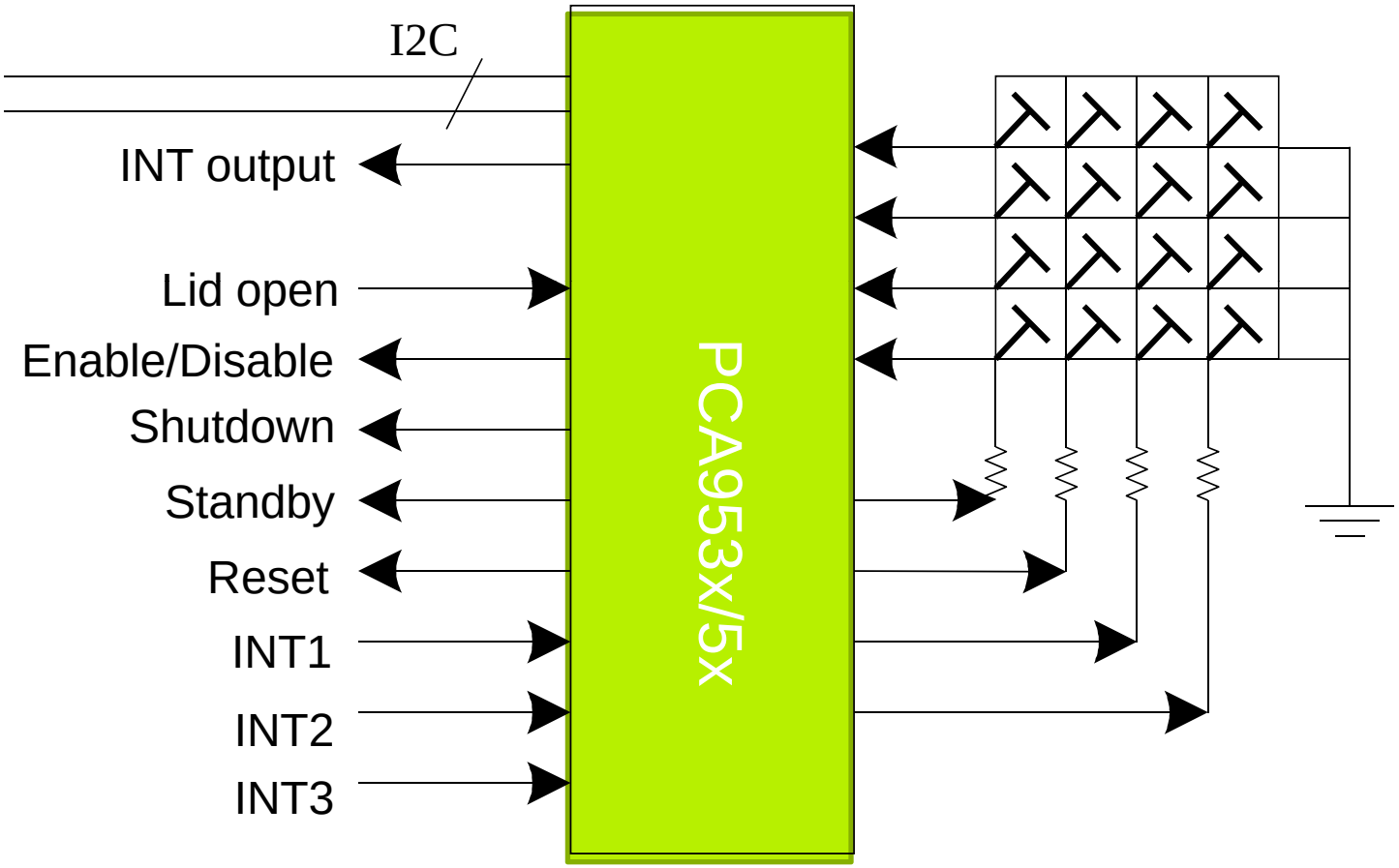
Benefits:
- Easy to add I/O (x8, x16) via I^2C
- Combat “Feature Creep” by expanding I/O port
- Avoid Costly Congested PCB

Integrated Functionality:
- Programmable On/Off Control
- Monitor Input State Change
- Blinking
- Dimming
-Voltage Translation (1.1-3.6V)
-**Seamless migration to newer Baseband ICs**

Optimized for Mobile:
-Low Power Consumption
-Low Vcc and bus voltage 1.1V-3.6V
- Hardware / RESET pin
- Programmable Pull-up/Pull Down
- Bus Hold Feature
- Small & Thin HWQFN package (3x3x0.8mm)

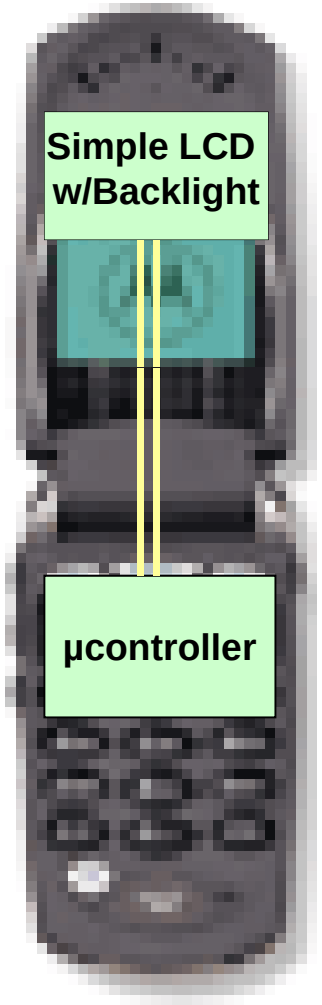
PCA953x/5x for key pad control

- Can be placed anywhere, only 2-wires pass through congested routing area

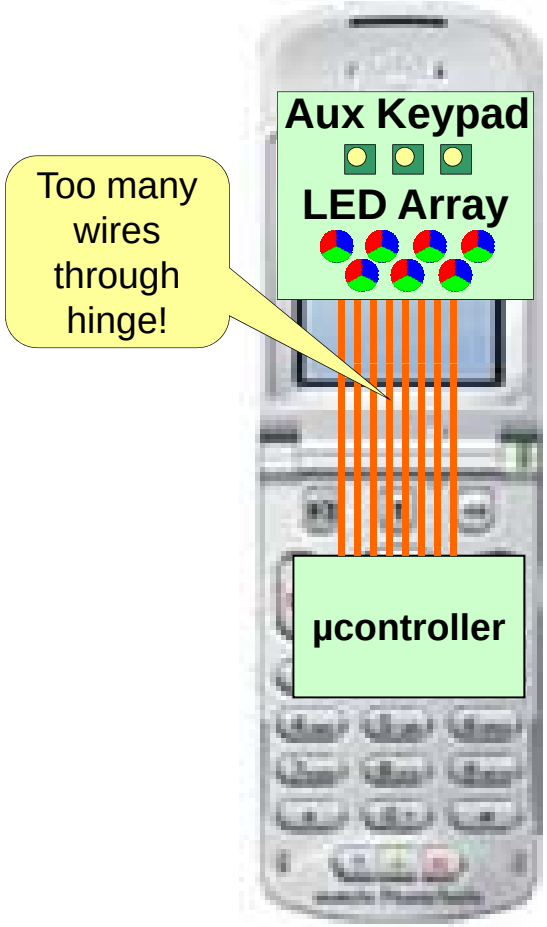


LED Controls via I²C

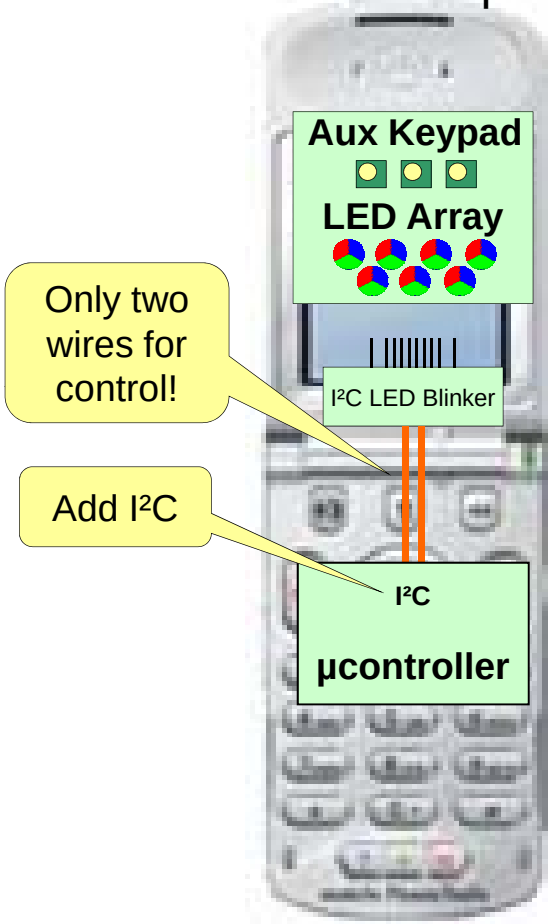
Old Design



New Design, new problems



I²C Solves the problem



LED Control and IO Expansion via I²C

PCA9633, PCA9634, PCA9635
PWM Control and Color Mixing for LCD Backlighting

IO Expanders:
PCA9537, PCA9534, PCA9535

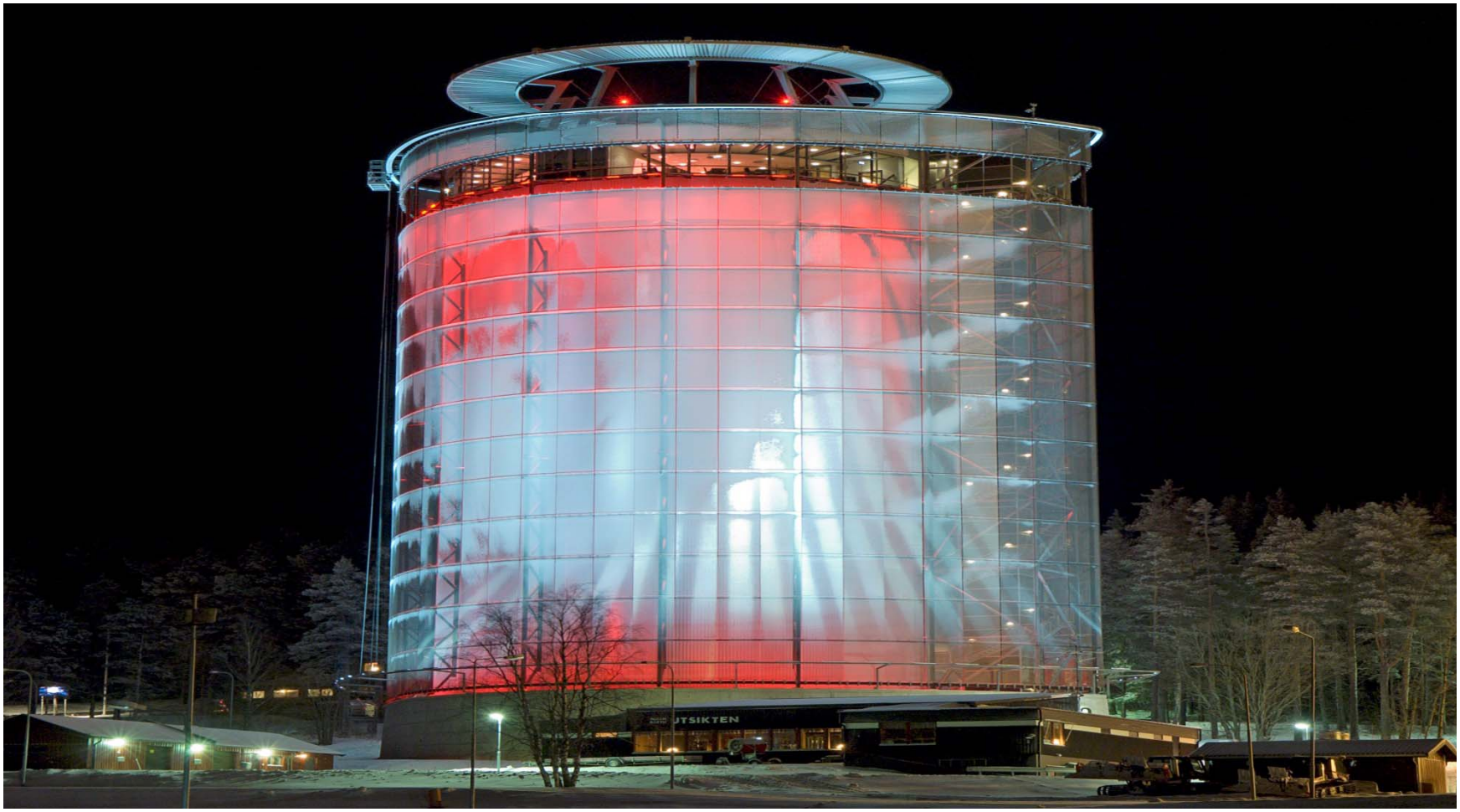
PCA9530-33
LED Dimmers

PCA9550-53
PCA9901 (1-Wire)
LED Blinkers

Application: Gaming/LED Sign

- LED Controllers

LED Controllers For Architectural And Accent Lighting



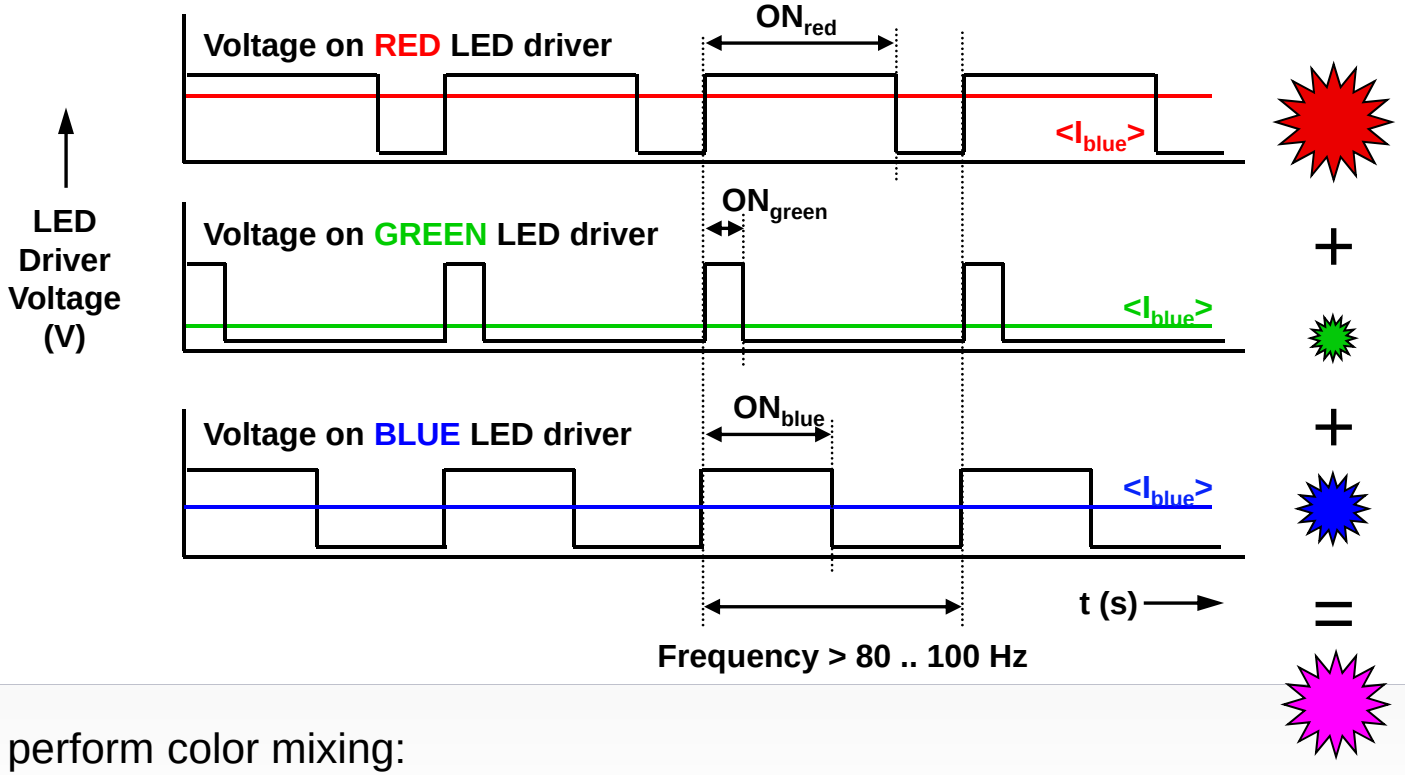
LED Controllers For Architectural And Accent Lighting

Features Needed

- Drive Medium to High Power Multiple Color LEDs
- Provide Flexible PWM Control
- Provide Simple Interface To Master Controller / Micro
- Provide Simple Command Sequences To Control Brightness And Color Mixing
- Offload Micro For Repetitive Sequences/Patterns
- Reduce Micro Firmware Overhead
- Provide Solution To Drive LEDs on Long Cables

I²C - LED Drivers, Blinkers and Dimmers

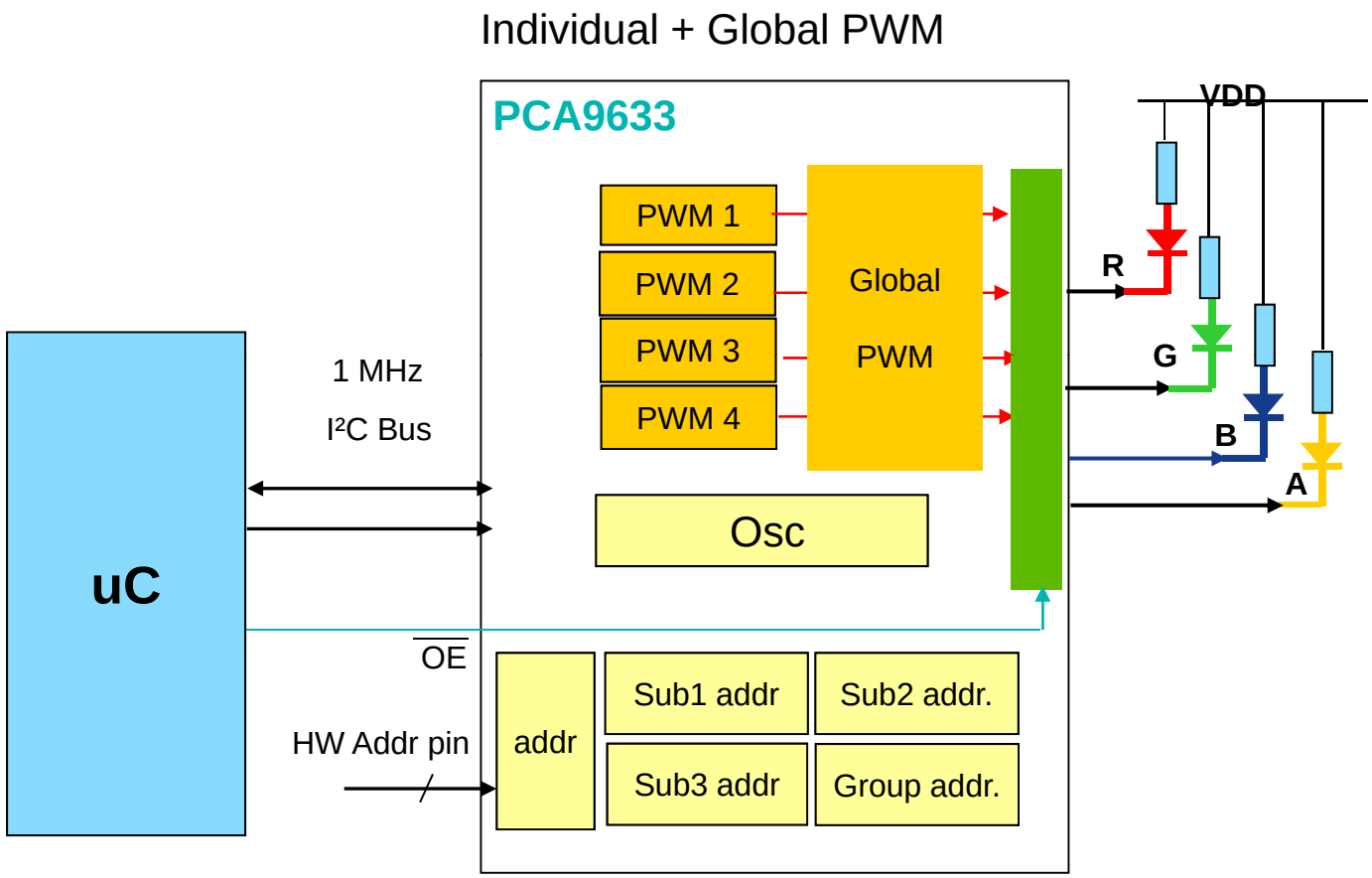
Using PWM for color mixing in RGB LED



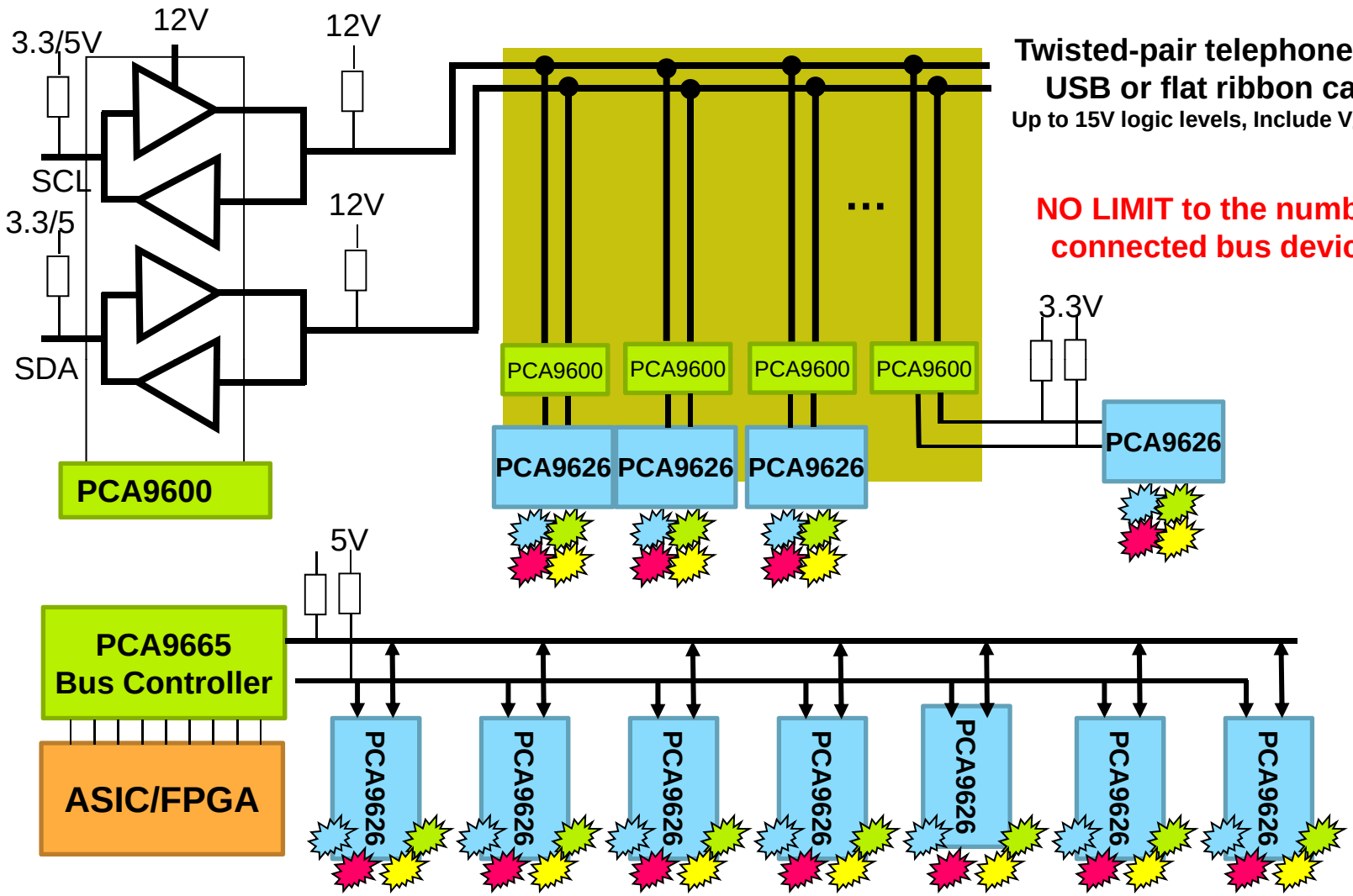
To perform color mixing:

- Frequency high enough so the human eye does not see the ON/OFF phases
- Brightness for each primary color (desired amount of each primary color) is controlled with the duty cycle
- Human eye sees the sum of primary colors' average brightness: X% Red + Y% Green + Z% Blue

I²C Color Mixing LED – PCA9633



LED Architectural Lighting



Twisted-pair telephone wires, USB or flat ribbon cables

Up to 15V logic levels, Include V_{CC} & GND

NO LIMIT to the number of connected bus devices !

LED Controllers For Signage And Large Displays

LED Controllers For Signage And Large Displays

Features Needed

- Drive Low To Medium Power Color LEDs
- Constant Current Drive For Predictable Brightness
- Serial Shift Data Mode
- LED Output Error Detection

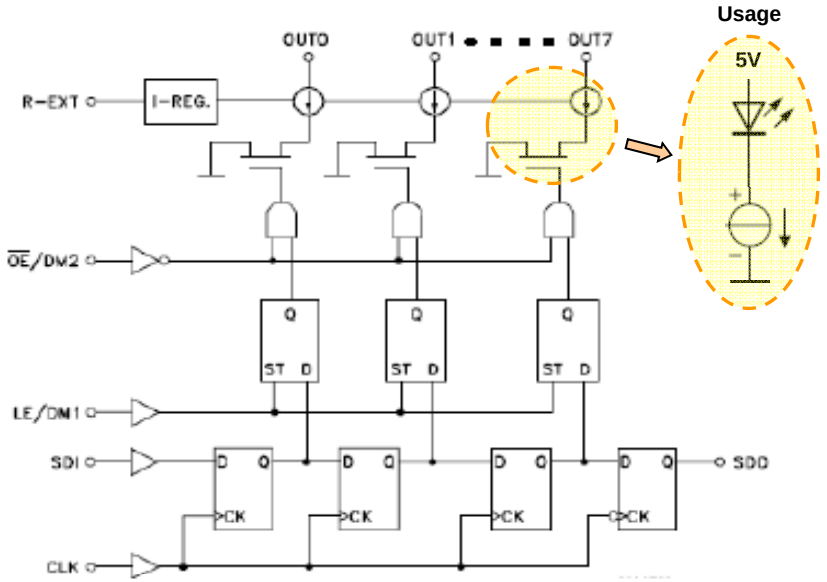
PCA9922 Serial Interface LED Controller

Constant Current Output LED Driver for large LED signs

Features

- 25 MHz serial interface
- 3.3 V to 5.5 V operation
- 8 LED low side constant current outputs
- Global control for the 8 LED outputs variable between 15 mA to 60 mA
- 5 mA to 60 mA maximum current for all 8 output channels set by an external resistor
  - Constant current matching at 25 °C, V_{DD} = 5.0 V
  - Bit-to-bit: ±6 %
  - Chip-to-chip: ±10 %
- Gradual turn-on/turn-off output to limit EMI
- Error detection mode for line open, output short to ground, LED open and LED short
- -40 C to +85 C operation

The PCA9922 is a pin-to-pin functionally equivalent 5 V alternative for the ST2221A and STP08CDC596.



LED Controllers Example Applications

LED Application – Mobile

LED Blinking, Dimming, Fun lighting Color mixing
Part Type: PCA9632

Flash LED Success Story in Mobile (SSL3250A)

LED Application – Consumer

Mouse & Pointing Devices

Part Type: PCA9633, 4, 5

LED Controller Success Story in JVC

Application: JVC LCD Backlight for Car Audio

Part Type: PCA9624PW

Description: 8-channel LED controller (40 V / 100 mA)

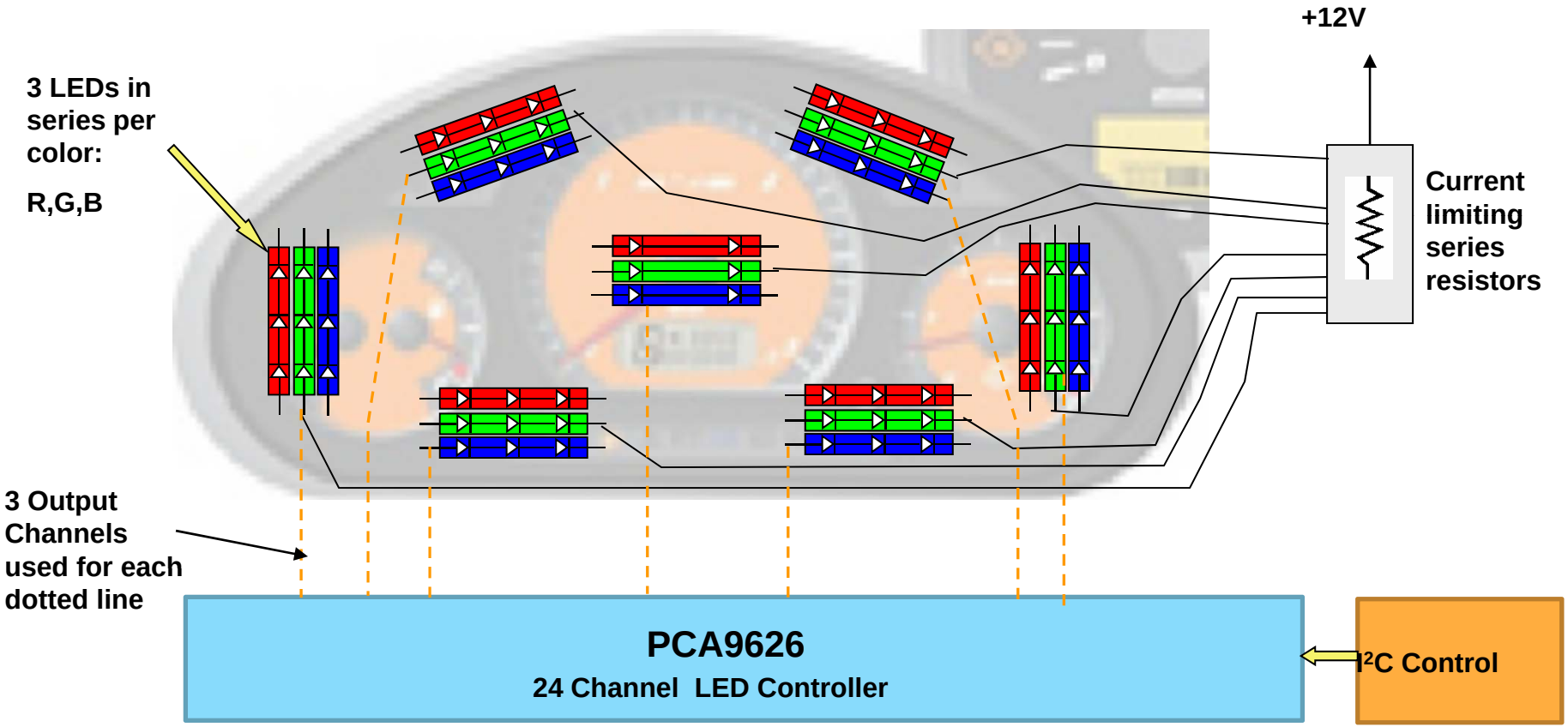
EAU: 1 M pcs

LED Controller – PCA9633

Application: Mouse, Headset, Keyboard

LED Application – Automotive Backlight

Application: PCA9626 Based Single Chip Automotive Cluster Lighting
Customer: Continental
EAU:



LED Controller – PCA962x

Application: Pachinko and Slot Machines

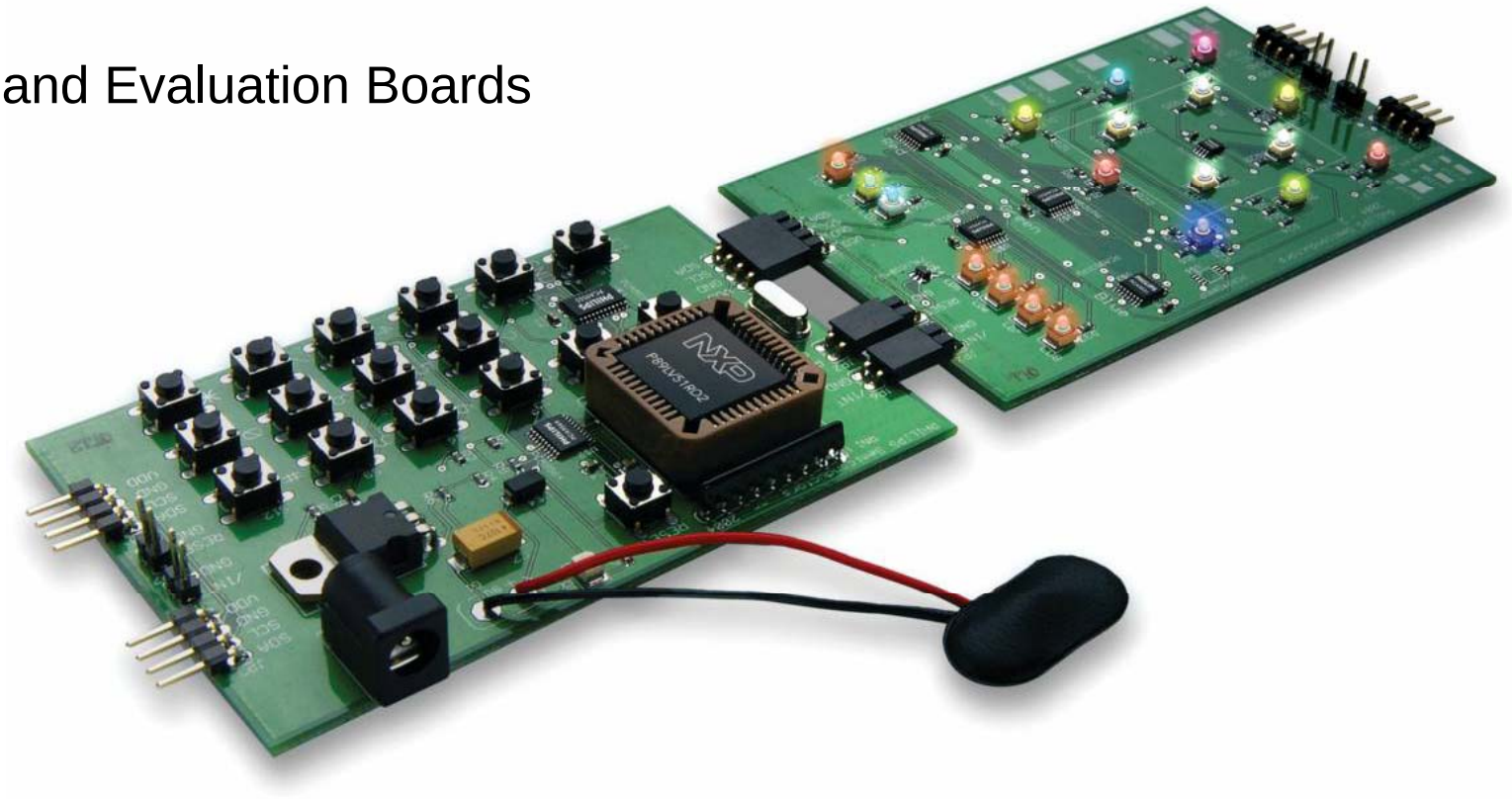
Party Type: PCA9622DR/S900
PCA9624DR/S900
PCA9626DR/S900

Description: 40 V /100 mV 8-, 16-, and 24- channel LED controllers

Which tools to help you win ?

I²C Demoboards

- Demo and Evaluation Boards

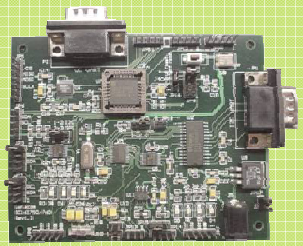


Evaluation/Demo Board List

OM#	Description
OM6270	SPI/I²C to UART Bridge Demoboard (SC16IS750)
OM6271	SPI to I²C Master Bridge Demoboard (SC18IS600)
OM6272	UART to I²C Master Bridge Demoboard (SC18IM700)
OM6273	SPI/I²C to Dual UART/IRDA/GPIO Demoboard (SC16IS752)
OM6274	I²C to SPI Master Bridge Demoboard (SC18IS602)
OM6275	I²C 2005-1 Demo Board (15 I²C devices w/USB control & GUI)
OM6276	PCA9633 Demo Board (Four Color PWM LED Control with Microcontroller)
OM6277	PCA9564 Eval Board (I²C Master)
OM6278	I²C 2002-1A Eval Board (11 I²C devices w/printer port control & GUI)
OM6279	LED Dimmer Demo Board
OM6281	PCA9698 Demo Board (Advanced 40-bit GPIO with PCA9530 LED blinker)
OM6276	PCA9633 Demo Board (Four Color PWM LED Control)
OM6285	I²C 2002-1A Eval Board (without/printer port control & GUI)
OM6290	I²C –bus LCD driver evaluation board
OM10088	PCF8562 LCD Segment Display

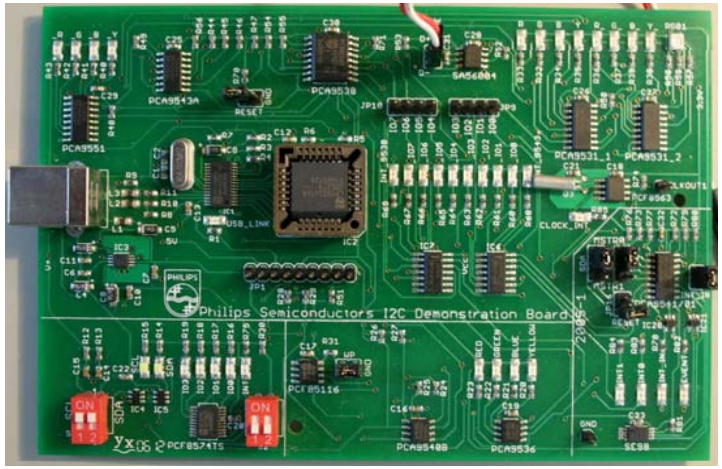
More information: www.ics.nxp.com/support/tools/interface

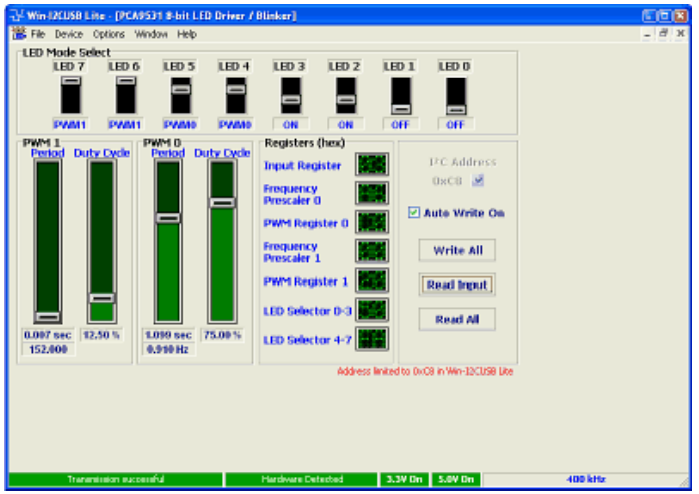
NXP Bridge IC – Demo Board Kits

I2C/SPI slave to UART	UART to I2C master	SPI to I2C master	I2C to SPI master
SC16IS7xx	SC18IM700	SC18IS600	SC18IS602
			
Kits include •Sample code: RS232, RS485, and IrDA •User Manual	Kits include •Sample code: RS232 and NXP I2C devices •User Manual	Kits include •Sample code: SPI and NXP I2C devices •User Manual	Kits include •Sample code: I2C and NXP SPI devices •User Manual
Key Benefit Easy interface to I2C/SPI host and IrDA, RS232/RS485, and GPIO devices. Selectable I2C or SPI-bus interface Up to 5Mbps!	Key Benefit Easy interface to UART host and various I2C and GPIO devices. On-board I2C EEPROM and I2C LED Dimmer	Key Benefit Easy interface to SPI host and various I2C and GPIO devices. On-board I2C EEPROM and I2C LED Dimmer	Key Benefit Easy interface to I2C host and SPI and GPIO devices. Up to 4 SPI chip selects
OM6270 – SC16IS750 OM6273 – SC16IS752	OM6271	OM6272	OM6274

Experience the variety of I²C peripherals with the latest I²C Training Board

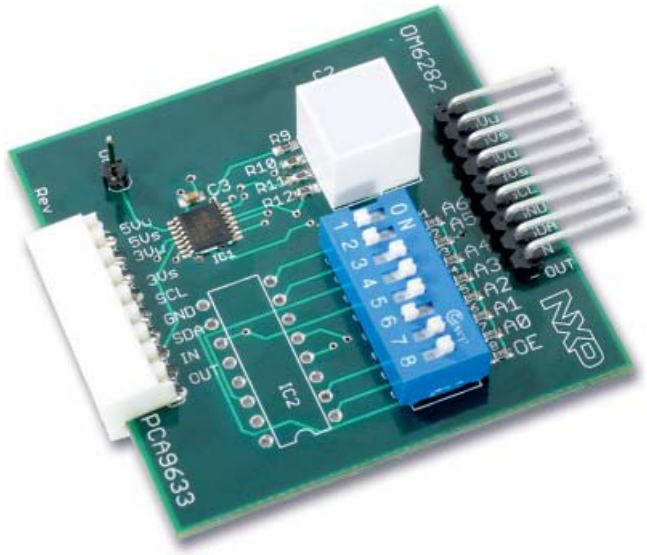
- Fifteen different I²C devices on one board allows easy experimentation and training. (PCA9531, PCA9536, PCA9538, PCA9540B, PCA9541, PCA9543A, PCA9551, PCF8563, PCF8574, PCF85116-3, SA56004, SE98)
- Add Extra I/O Ports, Temperature Sensors, LED Drivers, Real-time Clock, I²C Bus Switching
- USB Connection to trial version (only devices on board and that fixed address is operational) Graphics Interface for Windows PC/Laptop
- www.ics.nxp.com/support/boards/i2c20051/
- Target Board & USB based GUI (400 kHz) #**OM6275**





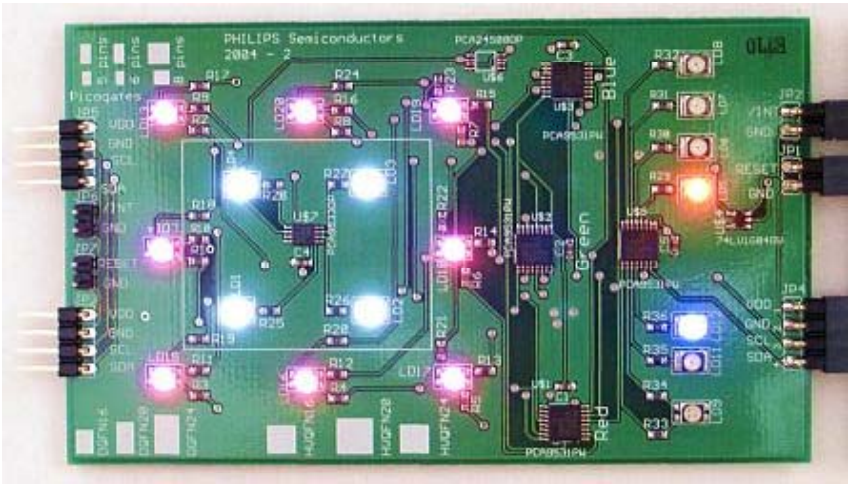
Get the color right with the single chip four color LED driver (R G B ?)

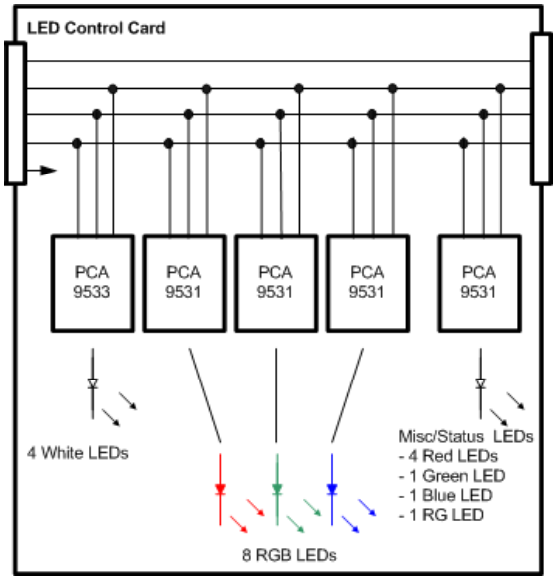
- Individual and Global PWM to set your perfect color and brightness or blink
- I²C interface for easy connection to Micro or Baseband IC
- Demo board with on board micro (LPC900) and FETs #**OM6276**
- Stand alone demo Board #**OM6282**
- www.ics.nxp.com/support/boards/pca9633/



Blink an LED without bit banging
Dim and LED without burning a PWM on the MCU

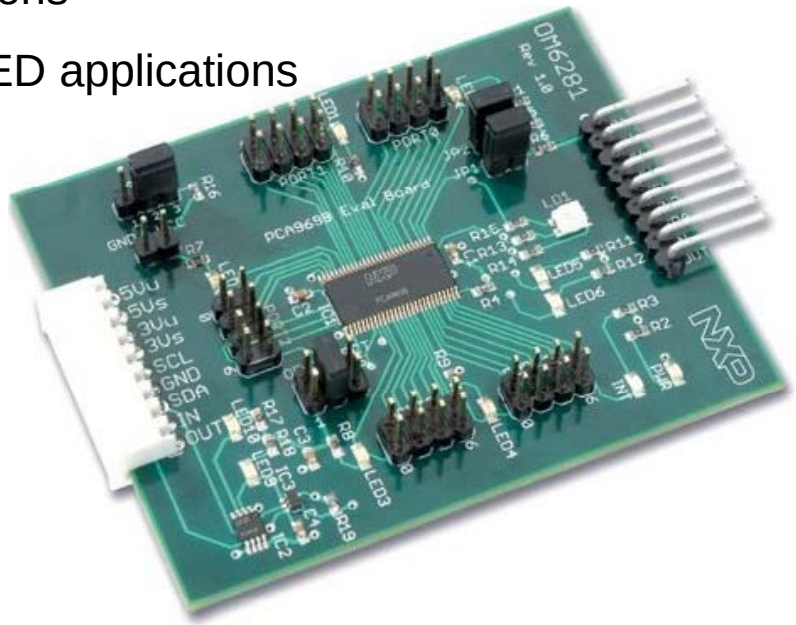
- Two PWMs to map across 2,4,8,16 outputs
  - 25 mA per pin
- I²C interface for easy connection to Micro or Baseband IC
- Demo Board with on board micro #**OM6279**
  - PCA9533, PCA9531
  - On-board NXP MCU demonstrates capabilities
  - www.ics.nxp.com/support/boards/leddemo





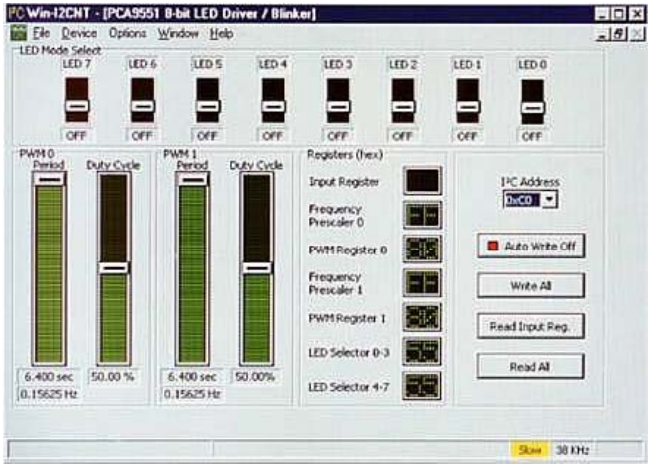
Easily Test and Demonstrate the PCA9698 40-Bit GPIO

- Demonstrates a wide range of functions
- 1MHz Fast-mode Plus I^2C-bus serial interface with 30mA drive
- 2.3 to 5.5V operation with 5.5V-tolerant I/O
- 40 configurable I/O pins that default to inputs at power-up
- Designed for live insertion in PICMG applications
- Onboard PCA9530 LED dimmer/blinker for LED applications
- Low standby current
- Demo board #**OM6281**
- www.ics.nxp.com/support/boards/pca9698/



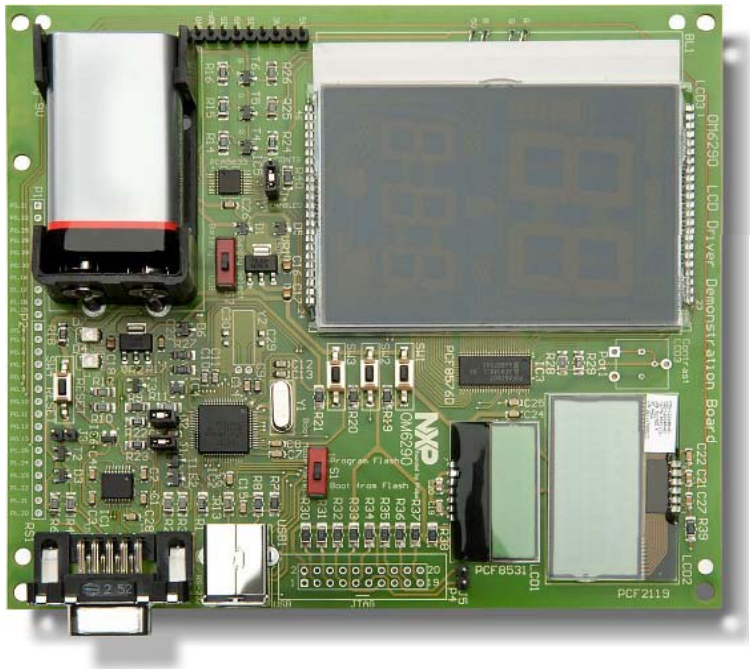
Train on many I²C peripherals using parallel printer port to PC

- Eleven different I²C devices on one board allows easy experimentation and training (LM75A, P82B96/PCA9600, PCA9501, PCA9515, PCA9543, PCA9550, PCA9551, PCA9554, PCA9555, PCA9561, PCF8582C-2)
- Add Extra I/O Ports, Temperature Sensors, LED Drivers, I²C Bus Switching
- I²C Bus adapter uses parallel printer port for connection to full version (all devices and addresses operational) of Graphics Interface for Windows PC/Laptop
- www.ics.nxp.com/support/boards/i2c20021/
- Target Board plus parallel printer port control (100 kHz) & GUI #**OM6278**
- Target Board only #**OM6285**



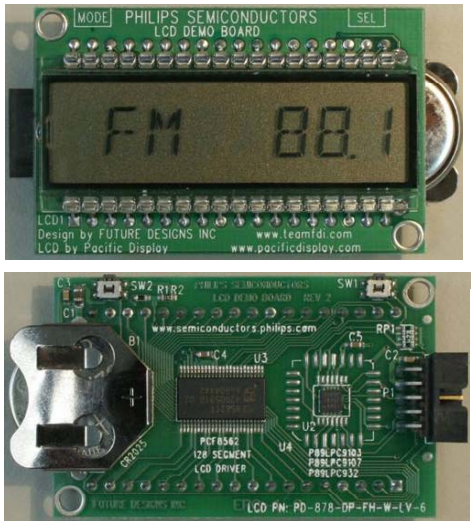
NXP I²C-bus LCD driver evaluation board (OM6290)

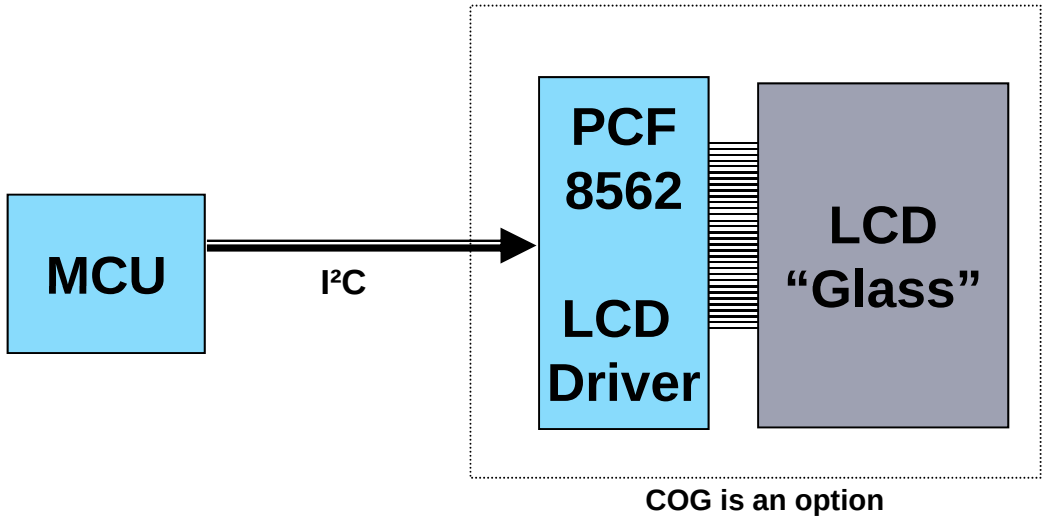
- The NXP I²C-bus LCD has three displays each controlled by an I²C-bus LCD driver.
- The segment display has a backlight driven by LED driver PCA9633.
- The board includes an NXP ARM7 microcontroller LPC2148
- Demo board #**OM6290**



Easily drive a LCD Segment Display with a very small MCU and PCF8562

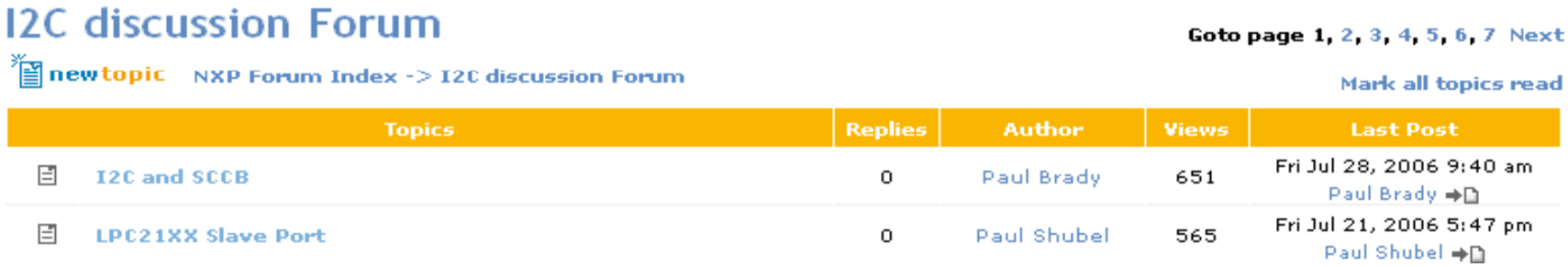
- Good for a User Interface at the front panel of a system
- Scalable to match the complexity of the LCD display
- Simple code using industry-standard 8051 core
- Easily reprogram micro via USB adapter (#OM10083)
- http://www.teamfdi.com/products/lcddemo/lcddemo.shtml
- Demo Board with on board micro #**OM10088**





Easy Access to I²C Technical Help

Three easy ways to ask technical questions and obtain answers



I2C discussion Forum

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Topics	Replies	Author	Views	Last Post
I2C and SCCB	0	Paul Brady	651	Fri Jul 28, 2006 9:40 am Paul Brady
LPC21XX Slave Port	0	Paul Shubel	565	Fri Jul 21, 2006 5:47 pm Paul Shubel

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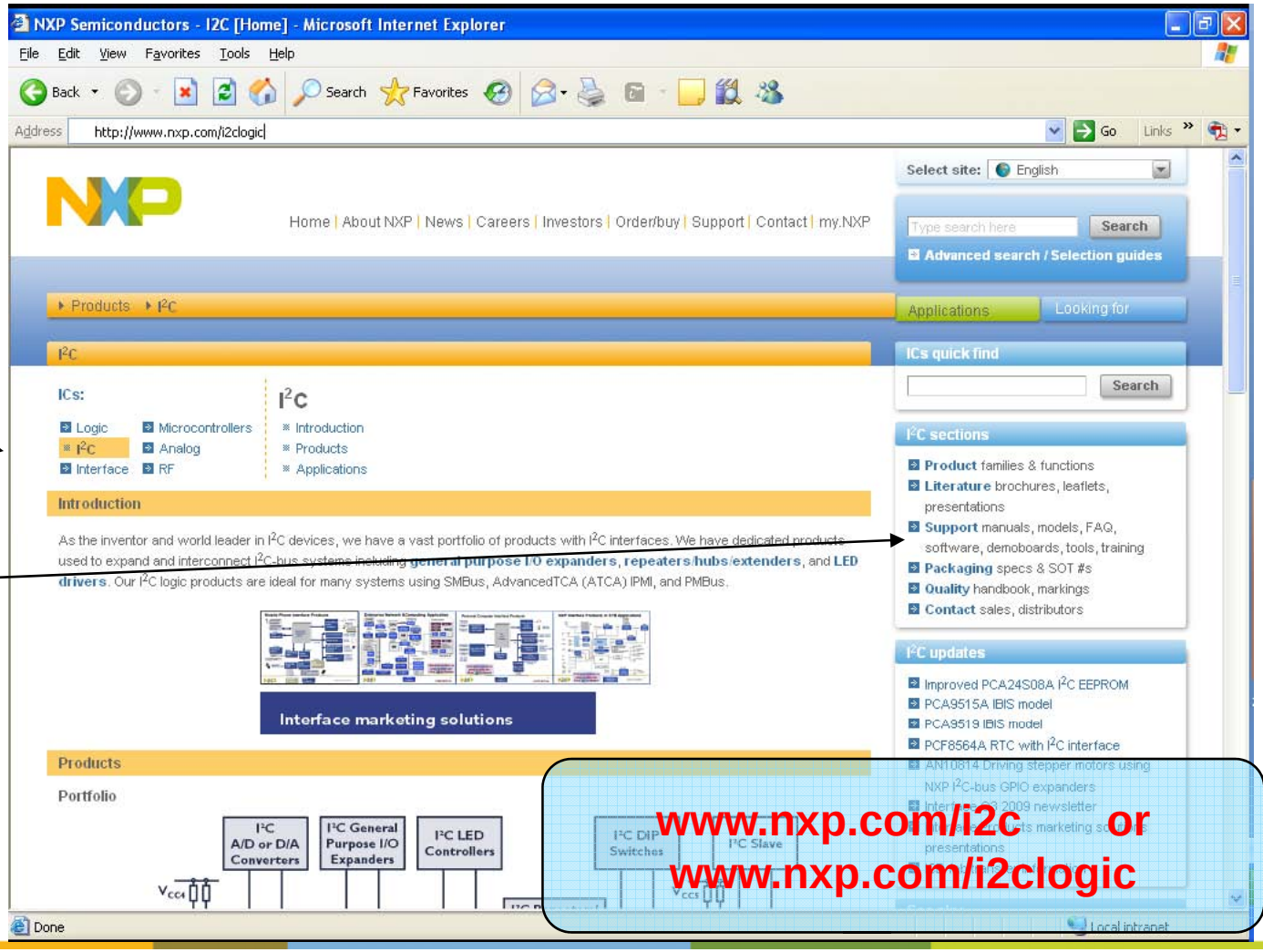
I²C Device Data Sheets, IBIS models Application Notes and Other Information

Product family descriptions line cards cross reference data sheets

Link to app notes models user guides PLL design software datasheets



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